



*Files are in Adobe format.  
Download the newest version from Adobe.*

## **Joint Armaments Conference, Exhibition & Firing Demonstration**

*"21<sup>st</sup> Century Weapon Systems – Providing the Right Response"*

**Dallas, TX**

**17 – 20 May 2010**

### **Agenda**

#### **Monday, May 17, 2010**

##### **TUTORIALS**

- DOD Instruction 5000.2, Ms. Karen Byrd, LCSC Learning Assistant Program Manager, DAU
- International Traffic in Arms Regulations, Government and Corporate Perspectives:
  1. Mr. Larry Christensen, Member Miller & Chevalier Chartered
  2. Mr. Moses E. Lewis, Executive Consultant to EME
- De Mystifying Intellectual Property and Data Rights: Government & Industry Perspectives, Mr. Tim Ryan, Technology Transfer Program Manager ARDEC

#### **Tuesday , May 18, 2010**

##### **KEYNOTE ADDRESS**

- BrigGen Michael M. Brogan, USMC, Commander, Marine Corps Systems Command
- BG Peter N. Fuller, USA, Program Executive Officer (PEO) Soldier

##### **DISTINGUISHED SPEAKER**

- Mr. George Solhan, SES, Deputy Chief of Naval Research (ONR 30)

##### **DISTINGUISHED SPEAKER**

- Mr. Michael Mulligan, President, General Dynamics Armament & Technical Products (ATP)

##### **DISTINGUISHED SPEAKER**

- Mr. Jay Tibbets, Senior Vice President, Business Development, ATK

##### **DISTINGUISHED SPEAKER**

- Mr. Hans Hoeneveld, Senior Program Manager Ammunition, Netherlands Defense Materiel Organization

## **BREAKOUT SESSIONS**

### **SMALL ARMS SYSTEMS**

9880 – Joint Service Small Arms Synchronization Team (JSSAST) Panel

- COL Scott Flynn, USA, Chairman
- LTC Tom Henthorn, USA
- CDR Thomas Gajewski, U.S. Navy
- Mr. Randy Roth, USAF

- LtCol Mark Brinkman, USMC
- CAPT Michael Price, USCG
- Mr. Kevin Swenson, Joint Non-Lethal

***PM SOLDIER WEAPONS***

- COL Tamilio, PM Soldier Weapons

***PM LEGAL ISSUES***

- 10194 - ITAR: The International Trade in Arms Regulation: Changes and Updates Relevant to the Small Arms Community, Mr. Jason Wong, Firearms Law Group
- 10199 - International Efforts to Regulate or Prohibit Military Small Arms Ammunition, Mr. Hays Parks, DoD OGC (1A)

**GUN & MISSILE SYSTEMS**

***PRECISION WEAPONS***

- 10034 - Mortar Guidance Kit (MGK), Ms. Kelly Hanink, ATK
- 10146 - Precision Guidance Kit (PGK), Mr. Tom Bybee, ATK
- 10174 - Improving the Accuracy of Precision Guided Munitions with a GPS Ephemeris & Ionospheric Correction Sharing Service (GEISS), Mr. Charles Johnson, NAVSYS Corporation

**KEYNOTE: *F-35 Weapon System Overview***

- Mr. Doug Hayward, Deputy Director F-35 Vehicle Systems, Lockheed Martin

***PLATFORMS***

- 9899 - MK 51 Modular Advanced Weapon System (MAWS), Mr. Steven Cannon, NSWC PHD Det Louisville
- 10595 - Gun Tube Wear Reduction for 105mm Artillery, Mr. Thomas Boncompain, General Dynamics, Ordnance and Tactical Systems Canada
- 10153 - Indirect Fires Precision and Lethality Enhancements through Digitization of Artillery and Mortar Weapon Systems, Mr. Victor Galgano, U.S. Army ARDEC
- 10190 - JSF Missionized Gun System, Mr. Douglas Parker, General Dynamics ATP
- 10235 - EFV 30mm Ammunition Feed System, Ms. Kim Perkins, General Dynamics ATP
- 10640 - Gun / Ammunition Acquisition Strategy for the EFV Program, Major Ian McDuffie, USMC, Head of Guns and Ammo APM-Mechanical Systems, PM AAA

***REQUIREMENTS & PROGRAM TRENDS***

- 10171 - Making Affordability Work, Mr. David Panhorst, U.S. Army ARDEC
- 10219 - Propulsion System Design in a Low Pressure Gun System, Mr. Carlton Adam, U.S. Army ARDEC

**Wednesday, May 19, 2010**

**LUNCHEON WITH SPEAKER - Landmark CD BRIGADIER GENERAL STEPHEN VINCENT BENET (1827-1895) - HIS LIFE AND TIMES**

- Dr. Stephen Small, JSSAP RDAR-EIJ, Picatinny Arsenal, NJ

**BREAKOUT SESSIONS**

**SMALL ARM SYSTEMS**

***WEAPONS***

- 10137 - Small Arms Weapon Integration on the Ramp of the V-22 Osprey, Mr. James Buechler, NSWC Crane
- The Kongsberg Common Remotely Operated Weapons Station: An Evolution in Capability for the Small Arms of Today to the Medium Cannon of Tomorrow, Mr. Westley “Bo” Barbour, Kongsberg Defence Systems
- 9915 - Advanced Remote/Robotic Armament System (ARAS), Mr. Robert Testa, U.S. Army ARDEC
- 9861 - Strategic Tripartite. Historic Opportunities for US and NATO Ground Combatants, Mr. Jim Schatz, Consultant



- 9863 - The Next Generation: The Case for a New NATO Rifle and Machine Gun Cartridge, Mr. Anthony Williams, Consultant

### ***INTERNATIONAL***

- 10690 - Is There a Problem With the Lethality of the 5.56 NATO Caliber, Mr. Per Arvidsson, NATO Weapons & Sensors Working Group
- 10000 - Grenade Launchers in China, Ms. Juanjuan Yang, China R&D Academy of Machinery
- 10055 - K11, Dual-Barrel Air-Burst Weapon, Dr. In Woo Kim, Agency for Defense Development, Korea
- 10136 - R&D Activities in Support of the Canadian Small Arms Replacement Project, Mr. Paul Harris, Defence Research and Development, Canada
- 10202 - Enhanced Warfighter Capability with Direct and Indirect Small Arms Ammunition, Mr. Jarl Eirik Straume, Nammo Raufoss AS, Norway
- 10201 - Developing IfraRed (IR) (Dim) Tracer Compositions for Reduced Signature, Mr. Peter Hedsand, Nammo Vanäsverken AB, Sweden
- 10200 - Developing Reduced Range Ammunition for Training and Urban Combat, Mr. Fredrik Erninge, Nammo Vanäsverken AB, Sweden

### ***MODELING & SIMULATION***

- 9898 - Application of IWARS in Small Arms Development, Mr. Alex Lee, U.S. Army ARDEC
- 9909 - Small Arms Modeling and Simulation, Mr. Clinton Fischer, U.S. Army RDECOM-ARDEC

### ***NON-LETHAL***

- 10070 - Advancements in Personnel Incapacitation Methodologies for Multiple Projectile Cartridges, Mr. Stephen Swann, Army Research Laboratory
- 10226 - Testing Non-lethals: Finding the Right Tools for the Job, Mr. Pascal Paulissen, TNO Defence, Security and Safety

### ***AMMUNITION***

- 9684 - Lethal Limited Range Round, Mr. Stephen McFarlane, U.S. Army
- 10004 - Small Caliber Propellant Solutions for the U.S. Military, Mr. Steve Faintich, St. Marks Powder, A General Dynamics Company
- 10149 - DARPA SCORPION Program Transition to Army Advanced Technology Objective Program: A Success Story, Mr. Andre Lovas, Georgia Tech Research Institute
- 10213 - Lightweight Small Caliber Ammunition (LSCA) Lessons Learned From Prototype Fabrication to Full Production Rates, Mr. George Feghali, General Dynamics OTS-Canada, Inc. & Mr. Bill Dittrich, Fleximation, Inc.
- 10172 - Aluminum 5.56 Case Development: Continued Success with an Advanced Lightweight Material, Mr. Christopher Still, ATK
- 10170 - Case Weight Variation Reduction and Subsequent Ballistic Dispersion Improvements in M118LR, Ms. Dionne Dillon, ATK Small Caliber Systems
- 10183 - .50 Caliber Steel Case Development: Design and Development of a Lightweight Case Compatible with Modernized Production Processes at the Lake City Army Ammunition Plant, Mr. Christian Miller, ATK Small Caliber Systems
- 10195 - Effects of Barrel Length on Sound Measurement, Bore Pressure, and Bullet Velocity, Dr. Philip Dater, Gemtech
- 10186 - MEMS S&A for Munitions, Mr. Dale Spencer, Kaman Precision Products
- 10650 - Developments in Short Range Training Ammunition, Mr. Luis de Sousa, General Dynamics OTS, Simunition Operations

### **GUNS & MISSILE SYSTEMS**

### ***EMERGING TECHNOLOGIES***

- 9894 - Design of an Intelligent Round Counter for Monitoring Ballistic Events Experienced by a Gun Barrel, Mr. Cory Mettler, American Science and Technology
- 10231 - The Rarefaction Wave Gun (RAVEN) Program, Mr. Mike Bixler, ARES, Inc.
- 9936 - "Lightening Strike"– An Indirect Fire Concept Utilizing Combustion Light Gas Gun (CLGG) Technology to Achieve Extreme Ranges, Mr. David Kruczynski, UTRON Inc. & Mr. Stephen Floroff, U.S. Army ARDEC
- 10135 - Hypersonic Plasma Particle Deposition Coating... Making 21st Century Weaponry Last into the 22<sup>nd</sup>, Mr. Daniel Fox, Rushford Hypersonic, LLC
- 10150 - Exo-atmosphere Propulsion for Hypersonic Projectiles, Dr. Wayne Sawka, DigitalSolid State Propulsion, LLC
- 10220 - Extended Area Protection and Survivability (EAPS) 50mm Cannon, Mr. Arthur Aeberli, U.S. Army ARDEC
- 10222 - Advanced Gun Barrel Technology Program, Background and Results, Mr. Bill Vezina, BAE Systems
- 10033 - Selectable Effects Warhead Technology Demonstration, Mr. Eric Volkmann, ATK

- 10151 - Ultrasonic Characterization of Explosively-Bonded Concentric Tubes, Mr. Chris Jerred, South Dakota State University
- 9910 - MagneLok™ Technology – Achieving High Torque-densities with a Novel Electromagnetically Actuated Band-brake, Mr. Scott Miller, LORD Corporation
- 9720 - Miniaturized ESAD Development, Mr. Ed Cooper, L-3 Fuzing and Ordnance Systems
- 9974 - Technology Trends in Fuzing and Munitions Power Sources, Mr. Oliver Barham, U.S. Army RDECOM-ARDEC
- 10143 - Low Volume, Negligible EMI Advanced Guided Bullet and Mortar Flight Control Actuators, Dr. Ron Barrett, University of Kansas

### ***ENERGETICS***

- 9878 - Unique Partnership to Provide Precision and Lethality to Tomorrow's Warfighter, Ms. Kelly Moran, ATK
- 9990 - High Performance BKNO<sub>3</sub> Igniter Formulations, Dr. Eugene Rozumov, U.S. Army ARDEC
- 10006 - Medium and Large Caliber Propellant Solutions, Mr. Robert Pulver, St. Marks Powder, A General Dynamics Company
- 10176 - Development of a Solventless Propellant for Use in 120mm Tank Training Rounds, Mr. Jim Wedwick, ATK
- 10001 - Ageing Effects on Performance of Small and Medium Calibre Ammunition, Mr. Chris Van Driel, TNO Defence, Security and Safety
- 10229 - The 155MM M795 Artillery Shell Loaded with IMX-101, Mr. Anthony DiStasio, U.S. Army ARDEC & Mr. Michael Ervin, BAE Systems

### ***DIRECT & INDIRECT FIRES***

- 9848 - 25mm Non-Energetic Fragmenting Cartridge, Mr. Rick Wright, General Dynamics
- 9857 - 120 MM XM360 Gun Program – Test & Evolution, Mr. David Smith P.E., U.S. Army Benet Laboratories
- 9862 - Howitzer Digitization Engineering Issues, Mr. William Key, IXSEA, Inc.
- 9869/10148 - Modeling of Composite Wrapped Cannon Barrel/Non-Destructive Inspection & Design, Dr. Zhong Hu, South Dakota State University & Dr. Jikai Du, South Dakota State University
- 9945 - Super 40mm to 30mm Ammunition Comparison – Performance/Lethality, Mr. Rick Wright, General Dynamic
- 10032 - The Advance Case System (ACS) program for 120mm Tank Training Ammo, Mr. Jeff Berg, TK
- 10225 - Warfare Has Changed: Investigation of the Performance of Ammunition in Maritime & Urban Environments, Mr. Martin van de Voorde, TNO Defence, Security and Safety
- 10157 - Modular Design of Direct Fire Medium Caliber Gun Systems for Joint Operations, Mr. Andrew Bradick, Consultant

### ***MODELING & SIMULATION***

- 9708 - Simulation of Cellulose Nitration Reaction, Mr. Mohamed (Mo) Elalem, U.S. Army ARDEC
- 10179 - Automated Projectile Design Software, Mr. Mark Steinhoff, Arrow Tech Associates, Inc.
- 10158 - Pyrotechnic Shock Loading of the M82 Percussion Primer in the M777 Light Weight Howitzer Magazine Assembly, Ms. Kathryn Hunt, Marine Corps Systems Command
- 9908 - Numerical and Experimental Comparison of Muzzle Brake Impulse Reduction on a 120mm Cannon System, Mr. Robert Carson, Benet Laboratories, U.S. Army ARDEC
- 10350 - Scalable Lethality: 'Dial-a-Yield' Approach to Greater Precision Engagement, Mr. Henry Kerwein, U.S. Army ARDEC
- 9707 - Modeling of Fluid Energy Milling Process, Mr. Mohamed (Mo) Elalem, U.S. Army ARDEC

**Thursday, May 20, 2010**

### **SMALL ARMS SYSTEM**

Session Chair: Chris Grassano, PM MAS

#### ***PM MAS***

- An Overview of Non-Standard Ammunition, LTC Robert Dionisio
- Training Ammunition Safety Initiatives, LTC Robertson, Product Director
- 40MM Ammunition: Evolving and Emerging Requirements, MAJ Marc Meeker, Assistant Product Manager, Medium Caliber Ammunition
- Small Caliber Ammunition: Enhancing Capabilities, LTC Jeffrey Woods, Product Manager, Small Caliber Ammunition

#### ***JSSAP***

- 9855 - Lightweight Small Arms Technologies, Mrs. Kori Phillips, U.S. Army ARDEC
- 10188 - JSSAP Futures 2012-2020, Dr. Barton Halpern, U.S. Army ARDEC

- 9895 - National Small Arms Center Update, Mr. Frank Puzycki, JSSAP Office, U.S. Army ARDEC
- 10193 - Advanced Lethal Armament Technology for Small Arms, Mrs. Sabbian Registe, ARDEC-RDECOM
- 9916 - Advanced Fire Control Technology for Small Arms Army Technology Objective (ATO), Mr. Terence F. Rice, U.S. Army ARDEC

**GUNS & MISSILE SYSTEM**

Distinguished Speaker: Mr. Edgar Fossheim, Nammo AS, Norway

***TACTICAL MISSILES & ROCKETS***

- 9714 - Demonstration and Validation of Lead-free Ballistic Modifier for Rocket Propellants, Dr. Sarah Headrick, ATK
- 10074 - Advanced Precision Kill Weapons System II, LCDR Nick Green, USN, Direct and Time Sensitive Strike Weapons PMA-242

***JOINT INTEREST***

- 10142 - Hovering Precision Weapons (HPW): Enabling Precise Surgical Strike and Collocated Close Air Support from Tactical to Strategic Distances, Dr. Ron Barrett, University of Kansas
- 10228 - CROWS II Vehicle Integration, Mr. Joseph Scheneck, PE, U.S. Army ARDEC
- 9827 - Environmentally Acceptable Alternatives to Lead Azide and Lead Styphnate, Dr. Michael Williams, Pacific Scientific EMC
- 10593 - Non-Incendiary Artillery Marking and Illumination Solutions, Mr. George Kurzik, General Dynamics – Ordnance and Tactical Systems & Mr. Ed Schmidt, Cyalume Technologies

# JOINT ARMAMENTS CONFERENCE, EXHIBITION & FIRING DEMONSTRATION

“21st Century Weapon Systems - Providing the Right Response”

## COMBINED PROGRAM ANNOUNCEMENT

### GUN & MISSILE SYSTEMS

Precision and Lethality in Medium  
and Large Caliber

### & SMALL ARMS SYSTEMS

Technology and Systems Sustaining  
and Evolving Small Arms  
Capability



HYATT REGENCY DALLAS — DALLAS, TX

MAY 17-20, 2010

EVENT #0610

[WWW.NDIA.ORG/MEETINGS/0610](http://WWW.NDIA.ORG/MEETINGS/0610)

## MONDAY, MAY 17, 2010

**8:00 am - 3:00 pm** Exhibitor Move-in - Marsalis Hall**8:00 am - 6:30 pm** Registration Open - Landmark Circle**1:00 pm - 2:45 pm TUTORIALS**▶ *Session Chair: Bob Glantz, ATK*

Cumberland A	Cumberland B
DOD Instruction 5000.2  <i>Ms. Karen Byrd, LCSC Learning Assistant Program Manager, DAU</i>	WSESRB Overview  <i>Mr. Jim Gerber &amp; Mr. Gary Vargo, NOSSA</i>

**3:00 pm - 4:45 pm TUTORIALS**

Cumberland A	Cumberland B
International Traffic in Arms Regulations, Government and Corporate Perspectives  <i>Mr. Larry Christensen, Member Miller &amp; Chevalier Chartered Mr. Moses E. Lewis, Executive Consultant to EME</i>	De Mystifying Intellectual Property and Data Rights: Government & Industry Perspectives  <i>Mr. Tim Ryan, Technology Transfer Program Manager ARDEC, Mr. Carlton Chen, VP Compliance &amp; Regulatory Affairs, Colt</i>

**5:00 pm - 6:30 pm RECEPTION IN MARSALIS HALL**

## TUESDAY, MAY 18, 2010

**7:00 am - 5:30 pm** Registration Open - Landmark Circle**7:00 am - 8:00 am** Continental Breakfast - Landmark Ballroom Foyer**8:00 am - 8:30 am WELCOME & ADMINISTRATIVE ANNOUNCEMENTS** - Landmark AB

- ▶ MG Barry Bates, USA (Ret), *Vice President, Operations, NDIA*
- ▶ Mr. David Broden, *Broden Resource Solutions; NDIA Armaments Division Chairman*
- ▶ Mr. Brian Tasson, *Director of Mechanical Design, ATK; Gun & Missile Committee Chairman*
- ▶ Mr. Brian Berger, *Vice President and General Manager, General Dynamics-OTS Canada; Small Arms Committee Chairman*

**8:30 am - 9:00 am KEYNOTE ADDRESS**

- ▶ MG Michael S. Repass, USA, *Commanding General, USASFC (Airborne)* - Cancelled

**9:00 am - 9:45 am KEYNOTE ADDRESS**

- ▶ BrigGen Michael M. Brogan, USMC, *Commander, Marine Corps Systems Command*
- ▶ BG Peter N. Fuller, USA, *Program Executive Officer (PEO) Soldier*

**9:45 am - 10:15 am** Morning Break in Marsalis Hall**10:15 am - 10:45 am DISTINGUISHED SPEAKER**

- ▶ Mr. George Solhan, SES, *Deputy Chief of Naval Research (ONR 30)*

**10:45 am - 11:15 am DISTINGUISHED SPEAKER**

- ▶ Mr. Michael Mulligan, *President, General Dynamics Armament & Technical Products (ATP)*

**11:15 am - 11:45 am DISTINGUISHED SPEAKER**

- ▶ Mr. Jay Tibbets, *Senior Vice President, Business Development, ATK*

**11:45 am - 12:15 pm DISTINGUISHED SPEAKER**

- ▶ Mr. Hans Hoeneveld, *Senior Program Manager Ammunition, Netherlands Defense Materiel Organization*

**12:15 pm - 1:30 pm AWARDS LUNCHEON** - Landmark CD



- ▶ CHINN AWARD presented to Mr. Frank Puzycki, U.S. Army ARDEC  
*Presented by Mr. Joel Goldman, U.S. Army ARDEC*
- ▶ HATHCOCK AWARD presented to Mr. Jeff Hoffman  
*Presented by Mr. Brian K. Sain on behalf of American Snipers*
- ▶ NDIA PROFESSIONAL SERVICE AWARD presented to Mr. Hays Parks  
*Presented by Mr. Brian Berger, General Dynamics*
- ▶ TRIFILETTI AWARD presented to Mr. Frank Bone  
*Presented by Mr. Brian Tasson, ATK*

**1:30 pm - 2:50 pm BREAKOUT SESSIONS**

- ▶ Joint Service Small Arms Synchronization Team (JSSAST)  
*Session Chair: COL Karl Scott Flynn, USA, Chairman, JSSAST*
- ▶ Precision Weapons  
*Session Chairs: Rob Brewer, NAVAIR & Jeff Siewert, Arrow Tech Associates, Inc.*
- ▶ Platforms  
*Session Chairs: Anthony Gabriele, U.S. Army, RDECOM-ARDEC & Matt Diehl, General Dynamics*
- ▶ Requirements & Program Trends  
*Session Chairs: Mark Serben, U.S. Army RDECOM - ARDEC & Steve Kelly, BAE Systems*

	Small Arms Systems	Gun & Missile Systems		
Time	Landmark B	Cumberland A-C	Landmark A	Reunion GH
	JSSAST			
1:30	9880 - JSSAST Panel		Keynote: F-35 Weapon System Overview  <i>Mr. Doug Hayward, Deputy Director F-35 Vehicle Systems, Lockheed Martin</i>	
	<ul style="list-style-type: none"> <li>• COL Scott Flynn, USA, Chairman</li> <li>• LTC Tom Henthorn, USA</li> <li>• CDR Thomas Gajewski, U.S. Navy</li> <li>• Mr. Randy Roth, USAF</li> <li>• LtCol Mark Brinkman, USMC</li> <li>• COL James Smith, USSOCOM</li> <li>• CAPT Michael Price, USCG</li> <li>• Mr. Kevin Swenson, Joint Non-Lethal</li> </ul>			
		Precision Weapons	Platforms	Requirements & Program Trends
2:10		9886 - Characterizing Performance of Precision Projectiles  <i>Mr. Jon Peoble, Raytheon Missile Systems</i>	9899 - MK 51 Modular Advanced Weapon System (MAWS)  <i>Mr. Steven Cannon, NSWC PHD Det Louisville</i>	
2:30		9896 - NavFire Guidance System – Integrated GPS and Mission Computer for Future Navigation Solutions  <i>Mr. Walter Trach Jr., Rockwell Collins</i>	10595 - Gun Tube Wear Reduction for 105mm Artillery  <i>Mr. Thomas Boncompain, General Dynamics, Ordnance and Tactical Systems Canada</i>	10171 - Making Affordability Work  <i>Mr. David Panhorst, U.S. Army ARDEC</i>

**2:50 pm - 3:30 pm** Afternoon Break in Marsalis Hall

**3:30 pm - 5:30 pm BREAKOUT SESSIONS**

- ▶ PM Soldier Weapons  
*Session Chair: COL Douglas Tamilio, USA, PM Soldier Weapons*
- ▶ PM Legal Issues  
*Session Chairs: Charles Buxton, Small Arms Ammunition and Testing (JXNN)*
- ▶ Precision Weapons  
*Session Chairs: Rob Brewer & Jeff Siewert, Arrow Tech Associates, Inc.*



## ► Platforms

*Session Chairs: Anthony Gabriele, U.S. Army, RDECOM-ARDEC & Matt Diehl, General Dynamics*

## ► Requirements &amp; Program Trends

*Session Chairs: Mark Serben, U.S. Army RDECOM - ARDEC & Steve Kelly, BAE Systems*

	Small Arms Systems	Gun & Missile Systems		
	Landmark B	Cumberland A-C	Landmark A	Reunion GH
Time	PM Soldier Weapons	Precision Weapons	Platforms	Requirements & Program Trends
3:30	Panel Discussion <i>COL Tamilio, PM Soldier Weapons</i> <i>LTC Chris Lehner, Individual Weapons Update</i>	10034 - Mortar Guidance Kit (MGK) <i>Ms. Kelly Hanink, ATK</i>	10021 - Remote Guardian System(TM) Defensive Weapon System <i>Mr. Adrian Gorsline, BAE Systems</i>	10219 - Propulsion System Design in a Low Pressure Gun System <i>Mr. Carlton Adam, U.S. Army ARDEC</i>
3:50	<i>LTC Michael Ascura, Crew Served Weapons Update</i>	10049 - 5-Inch Long Range Land Attack Projectile (LR-LAP) <i>Mr. Brandon Engle, BAE Systems</i>	10153 - Indirect Fires Precision and Lethality Enhancements through Digitization of Artillery and Mortar Weapon Systems <i>Mr. Victor Galgano, U.S. Army ARDEC</i>	
4:10		10146 - Precision Guidance Kit (PGK) <i>Mr. Tom Bybee, ATK</i>	10190 - JSF Missionized Gun System <i>Mr. Douglas Parker, General Dynamics ATP</i>	
	PM Legal Issues			
4:30	10194 - ITAR: The International Trade in Arms Regulation: Changes and Updates Relevant to the Small Arms Community <i>Mr. Jason Wong, Firearms Law Group</i>	10174 - Improving the Accuracy of Precision Guided Munitions with a GPS Ephemeris & Ionospheric Correction Sharing Service (GEISS) <i>Mr. Charles Johnson, NAVSYS Corporation</i>	10235 - EFV 30mm Ammunition Feed System <i>Ms. Kim Perkins, General Dynamics ATP</i>	
4:50	10199 - International Efforts to Regulate or Prohibit Military Small Arms Ammunition <i>Mr. Hays Parks, DoD OGC (1A)</i>		10640 - Gun / Ammunition Acquisition Strategy for the EFV Program <i>Major Ian McDuffie, USMC, Head of Guns and Ammo APM-Mechanical Systems, PM AAA</i>	

5:30 pm - 7:00 pm

RECEPTION IN MARSALIS HALL

Promotional Partner:



# WEDNESDAY, MAY 19, 2010

**7:00 am - 5:10 pm** Registration Open - Landmark Circle

**7:00 am - 8:00 am** Continental Breakfast - Landmark Ballroom Foyer

**8:00 am - 9:20 am BREAKOUT SESSIONS**

- ▶ Weapons  
*Session Chair: Rick Adams, FNH USA LLC*
- ▶ Ammunition  
*Session Chair: Bruce Webb, Nammo Talley, Inc.*
- ▶ Emerging Technologies  
*Session Chairs: Jay Brannam, ATK & Michael Thornton, NSWC*
- ▶ Direct & Indirect Fires  
*Session Chairs: Dave Wallestad, Wallestad & Associates, LLC & Joe McPherson, USMC*

	Small Arms Systems		Gun & Missile Systems	
Time	Landmark B	Cumberland A-C	Landmark A	Reunion GH
	Weapons	Ammunition	Emerging Technologies	Direct & Indirect Fires
8:00	10137 - Small Arms Weapon Integration on the Ramp of the V-22 Osprey  <i>Mr. James Buechler, NSWC Crane</i>	9684 - Lethal Limited Range Round  <i>Mr. Stephen McFarlane, U.S. Army</i>		9848 - 25mm Non-Energetic Fragmenting Cartridge  <i>Mr. Rick Wright, General Dynamics</i>
8:20	10144 - The 0.50 Caliber Multi-Mode Machine Gun and Family of Enhanced Ammunition: A Complete Weapon System for Remote Mounts, Fighting Vehicles and Aircraft  <i>Mr. Brian Sullivan, PMB, American Rheinmetall Munitions, Inc.</i>	10004 - Small Caliber Propellant Solutions for the U.S. Military  <i>Mr. Steve Faintich, St. Marks Powder, A General Dynamics Company</i>	9894 - Design of an Intelligent Round Counter for Monitoring Ballistic Events Experienced by a Gun Barrel  <i>Mr. Cory Mettler, American Science and Technology</i>	9857 - 120 MM XM360 Gun Program – Test & Evolution  <i>Mr. David Smith P.E., U.S. Army Benet Laboratories</i>
8:40	10084 - GAU-21 CDWS Platform Integration  <i>Mr. Bruce Richards, NSWC Crane</i>	10149 - DARPA SCORPION Program Transition to Army Advanced Technology Objective Program: A Success Story  <i>Mr. Andre Lovas, Georgia Tech Research Institute</i>	10231 - The Rarefaction Wave Gun (RAVEN) Program  <i>Mr. Mike Bixler, ARES, Inc.</i>	9862 - Howitzer Digitization Engineering Issues  <i>Mr. William Key, IXSEA, Inc.</i>
9:00	The Kongsberg Common Remotely Operated Weapons Station: An Evolution in Capability for the Small Arms of Today to the Medium Cannon of Tomorrow  <i>Mr. Westley "Bo" Barbour, Kongsberg Defence Systems</i>	10213 - Lightweight Small Caliber Ammunition (LSCA) Lessons Learned From Prototype Fabrication to Full Production Rates  <i>Mr. George Feghali, General Dynamics OTS-Canada, Inc. Mr. Bill Dittrich, Fleximation, Inc.</i>	9936 - "Lightening Strike" – An Indirect Fire Concept Utilizing Combustion Light Gas Gun (CLGG) Technology to Achieve Extreme Ranges  <i>Mr. David Kruczynski, UTRON Inc. Mr. Stephen Floroff, U.S. Army ARDEC</i>	9869/10148 - Modeling of Composite Wrapped Cannon Barrel/Non-Destructive Inspection & Design  <i>Dr. Zhong Hu, South Dakota State University Dr. Jikai Du, South Dakota State University</i>

**9:20 am - 10:00 am** Morning Break in Marsalis Hall

**10:00 am - 12:00 pm BREAKOUT SESSIONS**

**Ammunition Breakout  
Session Promotional  
Partner**

**10:00 AM - 11:00 AM**



- ▶ Weapons  
*Session Chair: Rick Adams, FNH USA LLC*
- ▶ Ammunition  
*Session Chair: Bruce Webb, Nammo Talley, Inc.*
- ▶ Emerging Technologies  
*Session Chairs: Jay Brannam, ATK & Michael Thornton, NSWC*
- ▶ Direct & Indirect Fires  
*Session Chairs: Dave Wallestad, Wallestad & Associates, LLC & Joe McPherson, USMC*
- ▶ International  
*Session Chair: John Edwards, U.S. Army ARDEC*

	Small Arms Systems		Gun & Missile Systems	
Time	Landmark B	Cumberland A-C	Landmark A	Reunion GH
	Weapons	Ammunition	Emerging Technologies	Direct & Indirect Fires
10:00	9915 - Advanced Remote/ Robotic Armament System (ARAS)  <i>Mr. Robert Testa, U.S. Army ARDEC</i>	10172 - Aluminum 5.56 Case Development: Continued Success with an Advanced Lightweight Material  <i>Mr. Christopher Still, ATK</i>	10135 - Hypersonic Plasma Particle Deposition Coating... Making 21st Century Weaponry Last into the 22nd  <i>Mr. Daniel Fox, Rushford Hypersonic, LLC</i>	10140 - 30mm x 113mm Traced Target Practice (TP- T) Munition  <i>Mr. Kyle Nerison, ATK Integrated Weapon Systems</i>
10:20	9861 - Strategic Tripartite. Historic Opportunities for US and NATO Ground Combatants  <i>Mr. Jim Schatz, Consultant</i>	10170 - Case Weight Variation Reduction and Subsequent Ballistic Dispersion Improvements in M118LR  <i>Ms. Dionne Dillon, ATK Small Caliber Systems</i>	10150 - Exo-atmosphere Propulsion for Hypersonic Projectiles  <i>Dr. Wayne Sawka, Digital Solid State Propulsion, LLC</i>	9945 - Super 40mm to 30mm Ammunition Comparison - Performance/ Lethality  <i>Mr. Rick Wright, General Dynamics</i>
10:40	9863 - The Next Generation: The Case for a New NATO Rifle and Machine Gun Cartridge  <i>Mr. Anthony Williams, Consultant</i>	10183 - .50 Caliber Steel Case Development: Design and Development of a Lightweight Case Compatible with Modernized Production Processes at the Lake City Army Ammunition Plant  <i>Mr. Christian Miller, ATK Small Caliber Systems</i>	10160 - Use of Non-metallic Materials in Gun-Launched Artillery Projectiles  <i>Mr. John Tilling, QinetiQ</i>	9946 - The 30mm x 173 PELE: The Single Shot Solution for Combat Vehicles and Surface Combatants  <i>Mr. Stephan Kerk, American Rheinmetall Munitions, Inc.</i>
	International			
11:00	10690 - Is There a Problem With the Lethality of the 5.56 NATO Caliber  <i>Mr. Per Arvidsson, NATO Weapons &amp; Sensors Working Group</i>	10195 - Effects of Barrel Length on Sound Measurement, Bore Pressure, and Bullet Velocity  <i>Dr. Philip Dater, Gemtech</i>	10220 - Extended Area Protection and Survivability (EAPS) 50mm Cannon  <i>Mr. Arthur Aeberli, U.S. Army ARDEC</i>	10032 - The Advance Case System (ACS) program for 120mm Tank Training Ammo  <i>Mr. Jeff Berg, ATK</i>
11:20	10000 - Grenade Launchers in China  <i>Ms. Juanjuan Yang, China R&amp;D Academy of Machinery</i>	10186 - MEMS S&A for Munitions  <i>Mr. Dale Spencer, Kaman Precision Products</i>	10222 - Advanced Gun Barrel Technology Program, Background and Results  <i>Mr. Bill Vezina, BAE Systems</i>	

	Small Arms Systems		Gun & Missile Systems	
11:40	10055 - K11, Dual-Barrel Air-Burst Weapon  <i>Dr. In Woo Kim, Agency for Defense Development, Korea</i>	10650 - Developments in Short Range Training Ammunition  <i>Mr. Luis de Sousa, General Dynamics OTS, Simunition Operations</i>	10141 - LW25 High Explosive Dual Purpose (HEDP) Munition  <i>Mr. Kyle Nerison, ATK Integrated Weapon Systems</i>	9905 - 25mm x 137 APEX Aircraft Ammunition  <i>Ms. Eva Friis, Nammo Raufoss AS, Norway</i>

**12:00 pm - 1:30 pm LUNCHEON WITH SPEAKER - Landmark CD**  
**BRIGADIER GENERAL STEPHEN VINCENT BENET (1827-1895) - HIS LIFE AND TIMES**

- ▶ Dr. Stephen Small, JSSAP RDAR-EIJ, Picatinny Arsenal, NJ

**1:30 pm - 2:50 pm BREAKOUT SESSIONS**

- ▶ International  
*Session Chair: John Edwards, U.S. Army ARDEC*
- ▶ Energetics  
*Session Chair: Enrico Mutascio, Esterline Defense Technologies & Matt Solverson, General Dynamics*
- ▶ Emerging Technologies  
*Session Chairs: Jay Brannam, ATK & Michael Thornton, NSWC*
- ▶ Direct & Indirect Fires  
*Session Chairs: Dave Wallestad, Wallestad & Associates, LLC & Joe McPherson, USMC*
- ▶ Modeling & Simulation  
*Session Chairs: Mike Stankus, EG&G Technical Services, Inc. & Steve Piper, Piper Pacific International*

	Small Arms Systems	Gun & Missile Systems		
Time	Landmark B	Cumberland A-C	Landmark A	Reunion GH
	International	Energetics	Emerging Technologies	Direct & Indirect Fires
1:30	10136 - R&D Activities in Support of the Canadian Small Arms Replacement Project  <i>Mr. Paul Harris, Defence Research and Development, Canada</i>	9878 - Unique Partnership to Provide Precision and Lethality to Tomorrow's Warfighter  <i>Ms. Kelly Moran, ATK</i>	10033 - Selectable Effects Warhead Technology Demonstration  <i>Mr. Eric Volkmann, ATK</i>	10225 - Warfare Has Changed: Investigation of the Performance of Ammunition in Maritime & Urban Environments  <i>Mr. Martin van de Voorde, TNO Defence, Security and Safety</i>
1:50	10202 - Enhanced Warfighter Capability with Direct and Indirect Small Arms Ammunition  <i>Mr. Jarl Eirik Straume, Nammo Raufoss AS, Norway</i>	9990 - High Performance BKNO3 Igniter Formulations  <i>Dr. Eugene Rozumov, U.S. Army ARDEC</i>	10151 - Ultrasonic Characterization of Explosively-Bonded Concentric Tubes  <i>Mr. Chris Jerred, South Dakota State University</i>	10157 - Modular Design of Direct Fire Medium Caliber Gun Systems for Joint Operations  <i>Mr. Andrew Bradick, Consultant</i>
				Modeling & Simulation
2:10	10201 - Developing IfraRed (IR) (Dim) Tracer Compositions for Reduced Signature  <i>Mr. Peter Hedsand, Nammo Small Arms Division, Sweden</i>	10006 - Medium and Large Caliber Propellant Solutions  <i>Mr. Robert Pulver, St. Marks Powder, A General Dynamics Company</i>	9910 - MagneLok™ Technology – Achieving High Torque-densities with a Novel Electromagnetically Actuated Band-brake  <i>Mr. Scott Miller, LORD Corporation</i>	9708 - Simulation of Cellulose Nitration Reaction  <i>Mr. Mohamed (Mo) Elalem, U.S. Army ARDEC</i>

	Small Arms Systems	Gun & Missile Systems		
2:30	10200 - Developing Reduced Range Ammunition for Training and Urban Combat  <i>Mr. Fredrik Erninge, Nammo Vanäsverken AB, Sweden</i>		9720 - Miniaturized ESAD Development  <i>Mr. Ed Cooper, L-3 Fuzing and Ordnance Systems</i>	10179 - Automated Projectile Design Software  <i>Mr. Mark Steinhoff, Arrow Tech Associates, Inc.</i>

**2:50 pm - 3:30 pm** Afternoon Break in Marsalis Hall

**3:30 pm - 5:10 pm BREAKOUT SESSIONS**

- ▶ Small Arms Modeling & Simulation  
*Session Chair: Mr. Matthew Cilli, U.S. Army ARDEC*
- ▶ Non-Lethal  
*Session Chair: Mr. Kevin Swenson, NLWS Directorate, MCSC, Quantico*
- ▶ Energetics  
*Session Chairs: Enrico Mutascio, Esterline Defense Technologies & Matt Solverson, General Dynamics*
- ▶ Emerging Technologies  
*Session Chairs: Jay Brannam, ATK & Michael Thornton, NSWG*
- ▶ Gun & Missile Modeling & Simulation  
*Session Chairs: Mike Stankus, EG&G Technical Services, Inc. & Steve Piper, Piper Pacific International*

	Small Arms Systems	Gun & Missile Systems		
Time	Landmark B	Cumberland A-C	Landmark A	Reunion GH
	Modeling & Simulation	Energetics	Emerging Technologies	Modeling & Simulation
3:30	9961/9962 - 40mm Low & Medium Velocity Munitions  <i>Mr. Cheng Hok Au, Singapore Technologies Kinetics</i>	10176 - Development of a Solventless Propellant for Use in 120mm Tank Training Rounds  <i>Mr. Jim Wedwick, ATK</i>	9974 - Technology Trends in Fuzing and Munitions Power Sources  <i>Mr. Oliver Barham, U.S. Army RDECOM-ARDEC</i>	10158 - Pyrotechnic Shock Loading of the M82 Percussion Primer in the M777 Light Weight Howitzer Magazine Assembly  <i>Ms. Kathryn Hunt, Marine Corps Systems Command</i>
3:50	9898 - Application of IWARS in Small Arms Development  <i>Mr. Alex Lee, U.S. Army ARDEC</i>	10001 - Ageing Effects on Performance of Small and Medium Calibre Ammunition  <i>Mr. Chris Van Driel, TNO Defence, Security and Safety</i>		9908 - Numerical and Experimental Comparison of Muzzle Brake Impulse Reduction on a 120mm Cannon System  <i>Mr. Robert Carson, Benet Laboratories, U.S. Army ARDEC</i>
4:10	9909 - Small Arms Modeling and Simulation  <i>Mr. Clinton Fischer, U.S. Army RDECOM-ARDEC</i>	10229 - The 155MM M795 Artillery Shell Loaded with IMX-101  <i>Mr. Anthony DiStasio, U.S. Army ARDEC &amp; Mr. Michael Ervin, BAE Systems</i>	10143 - Low Volume, Negligible EMI Advanced Guided Bullet and Mortar Flight Control Actuators  <i>Dr. Ron Barrett, University of Kansas</i>	10350 - Scalable Lethality: 'Dial-a-Yield' Approach to Greater Precision Engagement  <i>Mr. Henry Kerwien, U.S. Army ARDEC</i>
	Non-Lethal			
4:30	10070 - Advancements in Personnel Incapacitation Methodologies for Multiple Projectile Cartridges  <i>Mr. Stephen Swann, Army Research Laboratory</i>		10224 - Warfare Has Changed – So Should Have Methods: Experimental Investigation of the Performance of Modern Medium and Large Calibre Ammunition in Urban Terrain  <i>Mr. Theo Verhagen, TNO Defence, Security and Safety</i>	9707 - Modeling of Fluid Energy Milling Process  <i>Mr. Mohamed (Mo) Elalem, U.S. Army ARDEC</i>



	Small Arms Systems	Gun & Missile Systems		
4:50	10226 - Testing Non-lethals: Finding the Right Tools for the Job  <i>Mr. Pascal Paulissen, TNO Defence, Security and Safety</i>			

5:10 pm

CONFERENCE ADJOURNED FOR THE DAY

## THURSDAY, MAY 20, 2010

**7:00 am - 11:00 am** Registration Open - Landmark Circle

**7:00 am - 8:00 am** Continental Breakfast - Landmark Ballroom Foyer

### 8:00 am - 9:40 am BREAKOUT SESSIONS

- ▶ PM MAS  
*Session Chair: Chris Grassano, PM MAS*
- ▶ JSSAP  
*Session Chair: Joel Goldman, U.S. Army ARDEC*
- ▶ Tactical Missiles & Rockets  
*Session Chairs: Ed DePasqual, Nammo Talley, Inc. & John Bednarz, Raytheon Company*
- ▶ Joint Interest  
*Session Chairs: Doug Wong, PM MAS & Mike Stankus, EG&G Technical Services, Inc.*

	Small Arms Systems	Gun & Missile Systems	
Time	Landmark B	Landmark A	Reunion GH
	PM MAS		
8:00	<ul style="list-style-type: none"> <li>An Overview of Non-Standard Ammunition <i>LTC Robert Dionisio</i></li> </ul>	Distinguished Speaker:  <i>Mr. Edgar Fossheim, Nammo AS, Norway</i>	
8:30	<ul style="list-style-type: none"> <li>Training Ammunition Safety Initiatives <i>LTC Robertson, Product Director</i></li> <li>40MM Ammunition: Evolving and Emerging Requirements <i>MAJ Marc Meeker, Assistant Product Manager, Medium Caliber Ammunition</i></li> <li>Small Caliber Ammunition: Enhancing Capabilities <i>LTC Jeffrey Woods, Product Manager, Small Caliber Ammunition</i></li> </ul>	Distinguished Speaker:  <i>Mr. Patrick (Kevin) Peppe, Vice President, Naval Weapon Systems, Raytheon Company</i>	
	JSSAP	Tactical Missiles & Rockets	Joint Interest
9:00	9855 - Lightweight Small Arms Technologies  <i>Mrs. Kori Phillips, U.S. Army ARDEC</i>		10142 - Hovering Precision Weapons (HPW): Enabling Precise Surgical Strike and Collocated Close Air Support from Tactical to Strategic Distances  <i>Dr. Ron Barrett, University of Kansas</i>



JOINT ARMAMENTS CONFERENCE  
THURSDAY, MAY 20, 2010

	Small Arms Systems	Gun & Missile Systems	
9:20	10188 - JSSAP Futures 2012-2020 <i>Dr. Barton Halpern, U.S. Army ARDEC</i>	9714 - Demonstration and Validation of Lead-free Ballistic Modifier for Rocket Propellants <i>Dr. Sarah Headrick, ATK</i>	10228 - CROWS II Vehicle Integration <i>Mr. Joseph Scheneck, PE, U.S. Army ARDEC</i>

**9:40 am - 11:00 am BREAKOUT SESSIONS**

- ▶ JSSAP  
*Session Chair: Joel Goldman, U.S. Army ARDEC*
- ▶ Tactical Missiles & Rockets  
*Session Chairs: Ed DePasqual, Nammo Talley, Inc. & John Bednarz, Raytheon Company*
- ▶ Joint Interest  
*Session Chairs: Doug Wong, PM MAS & Mike Stankus, EG&G Technical Services, Inc.*

	Small Arms Systems	Gun & Missile Systems	
Time	Landmark B	Landmark A	Reunion GH
	JSSAP	Tactical Missiles & Rockets	Joint Interest
9:40	9895 - National Small Arms Center Update <i>Mr. Frank Puzyski, JSSAP Office, U.S. Army ARDEC</i>	<i>Morning Break - Landmark Ballroom Foyer</i>	
10:00	10193 - Advanced Lethal Armament Technology for Small Arms <i>Mrs. Sabbian Registe, ARDEC-RDECOM</i>	10074 - Advanced Precision Kill Weapons System II <i>LCDR Nick Green, USN, Direct and Time Sensitive Strike Weapons PMA-242</i>	10175 - Experimentation in Integrated Weapons Solutions for Unmanned Systems – Getting Past the Demonstration <i>Mr. Paul Balutis, iRobot</i>
10:20	9916 - Advanced Fire Control Technology for Small Arms Army Technology Objective (ATO) <i>Mr. Terence F. Rice, U.S. Army ARDEC</i>		9827 - Environmentally Acceptable Alternatives to Lead Azide and Lead Styphnate <i>Dr. Michael Williams, Pacific Scientific EMC</i>
10:40	9539 - Integrated Rifle Barrel Reference Sensor with Position Compensating Reticle <i>Mr. Slobodan Rajic, Oak Ridge National Laboratory</i>		10593 - Non-Incendiary Artillery Marking and Illumination Solutions <i>Mr. George Kurzik, General Dynamics – Ordnance and Tactical Systems</i> <i>Mr. Ed Schmidt, Cyalume Technologies</i>

**11:00 am - 6:00 pm CONTRACTOR FIRING DEMONSTRATION** Promotional Partner:

- ▶ *Session Chair: Sal Fanelli, U.S. Marine Corps*



**11:00 am - 11:30 am** Board Buses for Firing Demonstration - Hotel Lobby

**11:30 am - 12:40 pm** Buses En Route for Firing Range

**12:40 pm - 1:40 pm** Texas BBQ Lunch Provided by LaRue Tactical

**1:40 pm - 4:30 pm** Firing Demonstration - Spartan Tactical

**3:30 pm - 4:45 pm** Buses En Route for Hotel (first bus departs at 3:30 pm; last bus departs at 4:45 pm)

## POSTER PRESENTATIONS

The following posters will be displayed in Marsalis Hall throughout the conference. Authors will be available for discussion during morning and afternoon breaks, as listed in the agenda. Posters will be displayed in numerical order.

► *Session Chairs: Mr. Steve French, BAE Systems & Mr. Matt Ohlson, ATK*

9893 - Development of a Nondestructive Testing Field Inspection Vehicle Designed to Scan Cylindrical Structures  
*Mr. Cory Mettler, American Science and Technology*

9925 - Case Studies for Improved Sustainment of Bullet and Bullet Assembly Machines  
*Mr. Michael Coventry, Bliss Clearing Niagara Technical Services*

10005 - Fire Control Systems for Heavy Machine Guns: Winning the Current Fight while Simultaneously Modernizing for the Future  
*Mr. Richard Hollen, VingTech Corporation*

10100 - Liquid Ceramic Coatings for Signature Reduction in Small Arms  
*Dr. Leah Leavitt, NIC Industries, Inc.*

10126 - New Power, Lightweight Materials, and Sustainable Design Tools for Small Arms Systems  
*Mr. Blase Leven, Kansas State University*

10128 - Using Triboluminescence to Detect Impacts for Defense Applications  
*Dr. William Hollerman, University of Louisiana at Lafayette*

10138 - FEM Analysis of a Barrett M99 0.50 Caliber Rifle Barrel  
*Dr. Gary Anderson, South Dakota State University*

10145 - Determining Residual Stress of Ta Alloy Gun Tube  
*Dr. Tao Huang, South Dakota State University*

10155 - Characterization of the Emergent Flame and Transient Pressure History of the M299 Ignition Cartridge at 70°F and -50°F  
*Mr. Jon Conner, National Technical Systems (NTS)*

10168 - Individual Airburst Weapon System (IAWS)  
*Mr. Ryan Hurt, ATK*

10192 - Miniature Integrated Capacitive Discharge Unit for Detonation and Ignition  
*Mr. Frank Duva, Novacap, Inc.*

10236 - Analysis of Requirements for Engaging Defilade Targets with 40mm Grenades  
*Dr. Kevin Massey, Georgia Tech Research Institute*

10482 - Small Arms Mounted Radar Sensor for Improving Aiming Accuracy

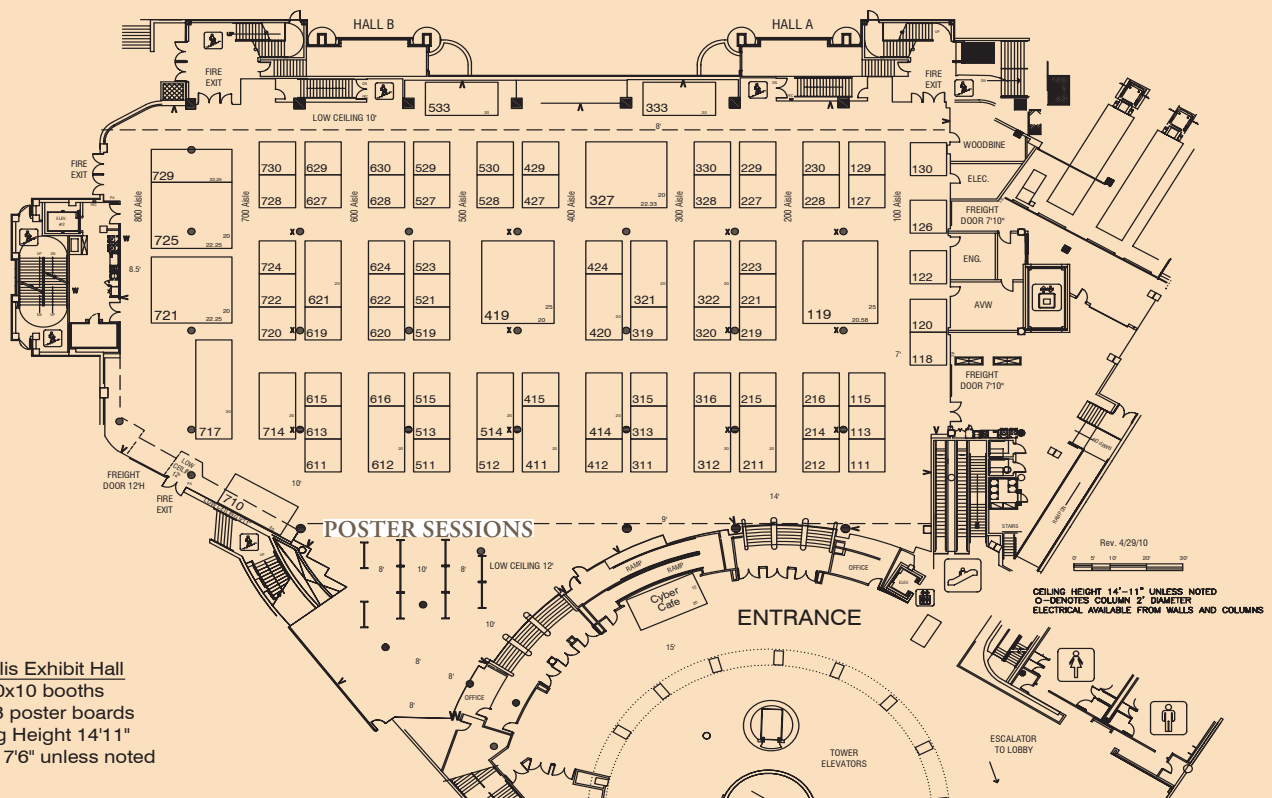
*Dr. Ram Narayanan, The Pennsylvania State University*

10578 - Small Caliber Dispersion Modeling  
*Mr. Jeff Siewert, Arrow Tech Associates, Inc.*

## EXHIBIT INFORMATION

Booth Number	Company Name
427.....	AAI Corporation
319.....	Advanced Armament Corporation
514.....	Aerojet
228.....	Aimpoint, Inc.
528.....	Alcoa Defense
412.....	American Rheinmetall Munitions, Inc.
513.....	Anniston Army Depot
725.....	ARDEC
530.....	Ares, Inc.
523.....	Arrow Tech
419.....	ATK
722.....	Barrett
612.....	Bulldog Tactical Equipment
321.....	Colt Defense, LLC
424.....	Combined Systems, Inc.
320.....	Competitive Edge Gunworks
333.....	Contract Fabrication & Design
529.....	Cornervision
512.....	Dayton T. Brown, Inc.
126.....	DTI Associates
710.....	ELCAN Optical Technologies
628.....	EMA Tactical
415.....	ENSINGER

Joint Armaments Conference, Exhibition & Firing Demonstration  
May 17-20, 2010  
Hyatt Regency Dallas  
Dallas, Texas



JOINT ARMAMENTS CONFERENCE  
EXHIBIT INFORMATION

119.....	FNH USA, Inc.
219.....	GEMTECH
621.....	General Dynamics Amphibious Systems
327.....	General Dynamics Armament and Technical Products
322.....	General Dynamics-OTS
316.....	GLOCK, Inc.
527.....	Heckler & Koch
115.....	Hogue, Inc.
118.....	Institute for Advanced Technology at the University of Texas
328.....	ITT Enidine, Inc.
717.....	Joint Service Small Arms Program
313.....	Kistler Instrument Corporation
216.....	Knight's Armament Company
627.....	L-3 Fuzing & Ordnance Systems
227.....	Lancer Systems
622.....	LaRue Tactical
212.....	Laser Devices, Inc.
122.....	Lasermix
724.....	Magpul Industries Corporation
730.....	Manroy USA
130.....	Martin Electronics, Inc.
511.....	MAST Technology, Inc.
629.....	Metal Storm, Inc.
720.....	MILKOR USA, Inc.
429.....	MSC Software Corporation
411.....	Nammo Talley, Inc.
521.....	National Technical Systems Corporation
613.....	NNSA's National Secure Manufacturing Center
414.....	Nobles Manufacturing, Inc.
315.....	Olin-Winchester
311.....	Otis Technology
619.....	PCB Piezotronics
214.....	Pelican Products
728.....	Platt Mounts - USA, Inc.
721.....	PM Soldier Weapons
211.....	Remington Arms
519.....	Ringfeder Corporation
129 & 215.....	RUAG Ammotec
533.....	S&T Daewoo
111.....	Sabre Defence Industries, LLC
113.....	Samson Manufacturing
611.....	Schmidt & Bender GmbH
330.....	Sierra Bullets
127.....	Sig Sauer
229.....	Small Arms Defense Journal
515.....	Smith & Wesson
120.....	Spa-Defense
630.....	Streamlight, Inc.
615.....	Sturm, Ruger
230.....	SureFire
223.....	Taser International
420.....	Trijicon
616.....	US Army Aberdeen Test Center
729.....	US Army RDECOM
312.....	US Ordnance
624.....	UTRON, Inc.
620.....	Vectronix, Inc.
714.....	VingTech Corporation
221.....	Wilcox Industries

**Exhibit Hours:**

Monday, May 17:

5:00pm - 6:30pm Opening Reception

Tuesday, May 18:

9:00am - 5:30pm

5:30pm - 7:00pm Reception

Wednesday, May 19:

9:00am - 3:30pm

**Save the Date!!!!**

**46th Annual Armament  
Systems: Gun & Missile  
Systems Conference &  
Exhibition**

**April 11-14, 2011**

**Miami, FL**

**[www.ndia.org/meetings/1590](http://www.ndia.org/meetings/1590)**

**International Infantry &  
Joint Services Small Arms  
Systems Symposium**

**May 23-26, 2011**

**Indianapolis, IN**

**[www.ndia.org/meetings/1610](http://www.ndia.org/meetings/1610)**



ATK is a premier aerospace and defense company with approximately \$4.8 billion in annual sales, more than 17,000 employees, and operations in 21 states and internationally. We bring non-traditional approaches to the market, with speed and innovation. ATK has signature expertise in delivering timely, advanced and affordable capabilities with reliable performance – in many cases economically upgrading current inventories with force multiplier affect.

ATK continues to expand its business as a leading provider of enhanced lethality and survivability solutions with core competencies in facility and supply chain management; small-and medium-caliber ammunition design and manufacture, medium-caliber gun system design and manufacture, and advanced propellant and energetics production. We are the technology leader in law enforcement, hunting and shooting sports ammunition, accessories and reloading supplies.

Our product line spans the breadth of individual and crew-served applications, from conventional and special-mission pistol and rifle ammunition, to 30mm and large-caliber for air, land and sea platforms. We have extended our supply chains to include not only U.S. and NATO specification ammunition, but non-standard products as well.

We are pioneering the development of enhanced tactical ammunition, including air bursting munitions, next generation energetics, and advanced propellants that will increase performance.

ATK offers an affordable 70mm precision system, Guided Advanced Tactical Rocket (GATR), which uses a semi-active laser guidance package to achieve extreme accuracy against both stationary and moving targets. GATR is a lock-on before or after launch system that supports integration on fixed/rotary wing and Unmanned Aircraft Systems platforms and is compatible with existing 2.75-inch launcher hardware.

ATK continues to enter new international markets supporting U.S., NATO, and allied forces with affordable, interoperable solutions in support of freedom. These offerings include mission-critical tactical systems and personal protection equipment, including load-bearing vests, hydration packs, holsters, bags, and slings.

ATK brings unmatched reliability and lethality in integrated weapon systems. We offer added value with fully integrated electronics and fire control capabilities supporting our innovative chain gun technology and medium-caliber ammunition systems, presenting a complete lethality package for today's ground and air platforms.

Additional ATK news and information can be found at [www.atk.com](http://www.atk.com).

## GENERAL DYNAMICS

### Armament and Technical Products

General Dynamics Armament and Technical Products, located in Charlotte, N.C., provides a broad range of system solutions for military and commercial applications.

The company designs, develops and produces high-performance weapon and armament systems, defensive armor, countermeasure systems and aerospace composite solutions, as well as off-road axle

and suspension systems. It is also a leading U.S. producer of biological and chemical detection systems.

#### Contact Info:

Kevin Sims  
Business Development Manager  
Four LakePointe Plaza  
2118 Water Ridge Parkway  
Charlotte, NC 28217  
Phone: 704-714-8291  
Fax: 702-714-8212

# LaRue Tactical



Located in Leander, TX, LaRue Tactical was founded as Austin Precision Products, Inc. (APPI) in 1980 as a precision machine shop servicing the technical markets, including microprocessors and the computer industry. In the early 90's, LaRue Tactical emerged from APPI, servicing the sniper community, and then quickly branched into design and production that supports all branches of the U.S. military world-wide. "LaRue" is now synonymous with Sniper Targets and Quick-Detachable Mounting

Systems for every optic, laser and NVD used by our soldiers. Our facilities house a large array of CNC work-centers, assembly, testing, inventory, and shipping areas. We are co-located with an underground shooting / testing range.

LaRue is known for providing the Warfighter the finest hardware available at the best value. Our specific niche is speed and agility in the production and delivery of field-worthy prototypes, integrating our patented Quick-Disconnect Speed Lever design into a variety of MIL-STD-1913 related products and accessories. The "repeatable" attributes of our manufactured hardware, even under the harshest conditions and most rigorous abuse have given LaRue an industry leadership reputation.

LaRue also designs and manufactures highly-accurate and dependable weapons systems, including the new 7.62 Optimized Battle Rifle (OBR). The OBR is an accurized gas-impingement AR-platform rifle that is available with 16", 18" or 20" barrels. Almost every part of the OBR is manufactured in-house, providing the ultimate in quality control that yields a consistent, sub-MOA rifle.

LaRue Sniper Targets are used by the sniper community world-wide. These robust steel targets are available in auto-resetting and remote-resetting models for calibers ranging from 5.56 through 50BMG. LaRue also provides several designs that are free-standing, reactive targets.

# MEGGITT

smart engineering for  
extreme environments

Meggitt Defense Systems Inc. (MDSI), specializes in the design, development and production of state-of-the-art medium caliber Linear Linkless ammunition handling systems and large caliber compact autoloaders in support of the United States military and her allies.

MDSI has a solid track record in meeting design-to-production requirements for increased capacity, reliability, and volumetric storage efficiency for ammunition handling systems.

MDSI provides a wide range of medium caliber Linear Linkless systems, all of which have been battle-proven. These include: AC-130U Gunship - 25mm, 3,000 rounds; Apache helicopter - 30mm, 1,200 rounds and 250 rounds (Combo PAK); Blackhawk helicopter - two 30mm magazines, 1,200 rounds and 660 rounds; Phalanx Reloaders - 20mm, 1,500 rounds; and LALS Reloaders - 20mm, 2,100 rounds. Additionally, development programs are underway for 30mm Mk44 Linkless feed systems, 35mm systems, and 40mm systems. Further, a new 20mm Linkless system is now in production, replacing the existing linked system on the Cobra helicopter.

Linkless feeding systems allow simultaneous upload and download of rounds and spent cases (where required), providing weapon system efficiency on the battlefield. Linear Linkless systems are more efficient, lighter, and, most importantly, are more reliable than linked systems. Our feed and transfer systems maintain complete control of rounds as they are fed directly into the gun without wasted space. In the end, this means maintaining multi-year high reliability records. More importantly, it means that in the heat of combat war fighters don't have to be concerned with whether or not their ammunition system will jam and fail them.

MDSI has developed large caliber Compact Autoloader and magazine systems for 105mm, 120mm, 140mm and 155mm. They are electrically or hydraulically-driven, fully automatic battlefield robotics systems. Examples range from prototypes for Main Battle Tanks to today's Stryker Mobile Gun System and to next-generation combat platforms.

As the technology leader in ammunition handling and storage systems, Meggitt Defense Systems Inc. is proud to be a sponsor for the NDIA Joint Armaments Conference.



NATIONAL DEFENSE INDUSTRIAL  
ASSOCIATION

2111 WILSON BOULEVARD, SUITE 400

ARLINGTON, VA 22201-3061

(703) 522-1820

(703) 522-1885 FAX

WWW.NDIA.ORG

## JOINT ARMAMENTS CONFERENCE, EXHIBITION & FIRING DEMONSTRATION

*"21st Century Weapon  
Systems - Providing the  
Right Response"*



MAY 17-20, 2010  
HYATT REGENCY DALLAS  
DALLAS, TEXAS

THANK YOU TO OUR PROMOTIONAL PARTNERS!




# BAE SYSTEMS

## GENERAL DYNAMICS

Armament and Technical Products

LaRue  
Tactical

A white outline map of the state of Texas is positioned to the right of the text "LaRue Tactical".

# MEGGITT

smart engineering for  
extreme environments



**DEFENSE ACQUISITION UNIVERSITY**  
*Learn. Perform. Succeed.*



# **DoDI 5000.02 & Implementation of the Weapon Systems Acquisition Reform Act of 2009 & New Changes to Policy**

Karen Byrd  
Learning Capabilities Integration Center  
Learning Asset Program Manager  
May 2010



'02 '06



'05 '06 '07



'04 '06 '07 '09



'03 '04



# Beyond Goldwater-Nichols

## Reforming Defense Acquisition for the 21st Century

The sheer complexity of the capability requirements, acquisition and resource allocation processes used to equip the U.S. military seemingly condemns the Defense Department to the perpetual task of acquisition reform. Ideally, acquisition is synchronized with requirements generation and resource allocation; organizations are aligned with policy; and the entire system responds adaptively to a changing security environment.



In reality, the uneven pace of reform between the major processes, the fact that **policies change faster than organizations, and a changing external landscape all generate friction and lead to an acquisition process that is too slow, not responsive enough to joint needs, too expensive and too complex**. Even if the policies, organizations, personnel, and cultures could be perfectly optimized to today's security environment, the reward would likely be a change in the external landscape requiring yet another round of reform. If Sisyphus had a job in the Pentagon, it would be acquisition reform.

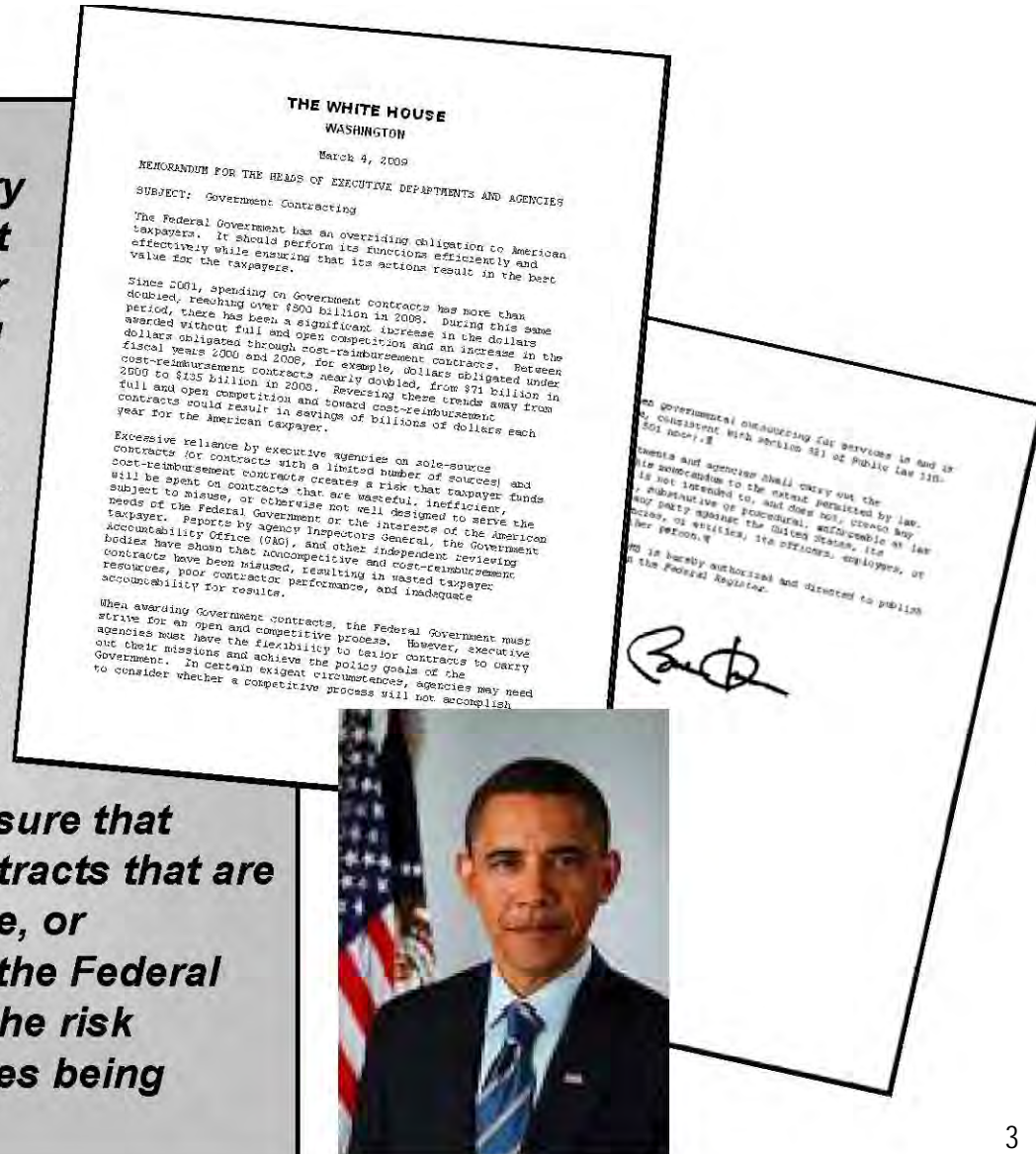




# Presidential Direction

***“... it is essential that the Federal Government have the capacity to carry out robust and thorough management and oversight of its contracts in order to achieve programmatic goals, avoid significant overcharges, and curb wasteful spending. A GAO study last year of 95 major defense acquisitions projects found cost overruns of 26 percent, totaling \$295 billion over the life of the projects. Improved contract oversight could reduce such sums significantly.*”**

***“... the Federal Government shall ensure that taxpayer dollars are not spent on contracts that are wasteful, inefficient, subject to misuse, or otherwise not well designed to serve the Federal Government's needs and to manage the risk associated with the goods and services being procured. ...”***





# Secretary of Defense Direction

*Chief among institutional challenges facing the Department is acquisition."*

**"First, this department must consistently demonstrate the commitment and leadership to stop programs that significantly exceed their budget or which spend limited tax dollars to buy more capability than the nation needs...**

**Second, we must ensure that requirements are reasonable and technology is adequately mature to allow the department to successfully execute the programs...**

**Third, realistically estimate program costs, provide budget stability for the programs we initiate, adequately staff the government acquisition team, and provide disciplined and constant oversight.**

**We must constantly guard against so-called "requirements creep," validate the maturity of technology at milestones, fund programs to independent cost estimates, and demand stricter contract terms and conditions."**

*Secretary of Defense Robert M. Gates*





# Comparison of 2003 vs. 2008

User Needs & Technology Opportunities

## Defense Acquisition Management Framework- 2003

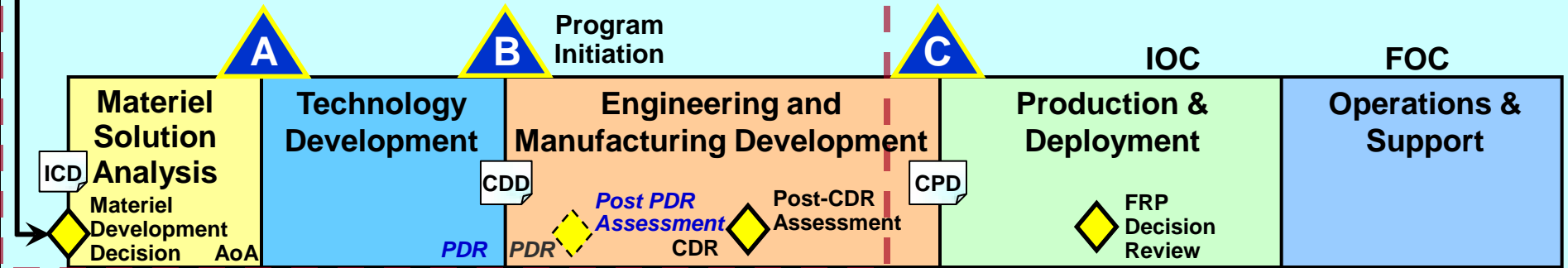


Focus of major changes

## Defense Acquisition Management System - 2008

User Needs

Technology Opportunities & Resources







# Weapons Systems Acquisition Reform Act



“The key to successful acquisition programs is **getting things right from the start** with sound systems engineering, cost estimating, and developmental testing early in the program cycle. The bill that we are introducing today will require the Department of Defense to take the steps needed to put major defense acquisition programs on a **sound footing from the outset**. If these changes are successfully implemented, they should help our acquisition programs avoid future cost overruns, schedule delays, and performance problems.”

—*Senator Carl Levin, Chairman, Senate Armed Services Committee*

“The Weapon System Acquisition Reform Act of 2009 is an important step in efforts to reform the defense acquisition process. This legislation is needed to focus acquisition and procurement on emphasizing systems engineering; **more effective upfront planning and management of technology risk**; and growing the acquisition workforce to meet program objectives.”

—*Senator John McCain, Ranking Member, Senate Armed Services Committee*



# Implementation of the Weapon Systems Acquisition Reform Act (WSARA) of 2009

## WSARA:

- Signed by President May 22, 2009 (Public Law 111-23)
- Established requirements that directly impact operation of the Defense Acquisition System and duties of key officials
- Directive-Type Memorandum (DTM) 09-027, 4 Dec 2009, implements WSARA
- DTM amends Acquisition Policy in DoDI 5000.02 the Defense Acquisition Guidebook and the Defense Federal Acquisition Regulation Supplement (DFARS)
- The DTM is effective immediately and will be incorporated into the above within 180 days.

*WSARA DTM is available at <http://www.ditc.mil/whs/directives>*



# Implementation of WSARA Changes to Policy and Procedure

1. Analysis of Alternatives Study Guidance
2. Acquisition Strategies to Ensure Competition
3. Competition and Considerations for the Operation and Sustainment (O & S) of Major Weapon Systems
4. Competitive Prototyping
5. Cost Estimation
6. Developmental Test and Evaluation (DT&E)
7. Systems Engineering
8. Performance Assessments and Root Cause Analysis (PARCA)
9. Assessment of **MDAP** Technologies
10. Preliminary Design Reviews (PDR)
11. Certification IAW 10 USC 2366a and 2366b
12. Critical Cost Growth
13. Revised **MDAP** Definition

Most apply to **MDAPs** (ACAT I); some apply to **MAIS** (ACAT IA); some apply only to **MDAPs/MAIS** for which USD(AT&L) is MDA (ACAT ID/IAM); some apply to Major Weapon Systems (ACAT II); some apply to non-major programs



# Implementation of WSARA AoA Study Guidance

- Director, Cost Analysis and Program Evaluation (DCAPE)
  - Leads development of AoA Study Guidance, for
  - Joint requirements for which JROC is validation authority
- Milestone Decision Authority (MDA) directs initiation of the AoA in Materiel Development Decision (MDD) Acquisition Decision Memorandum (ADM)
- AoA Study Guidance is attachment to the ADM

- DCAPE consolidates the responsibilities of Dir, Program Analysis & Evaluation (Dir, PA&E) and Chairman, Cost Analysis Improvement Group (CAIG)
- JROC Validates “JROC Interest” requirements - applies to all potential and designated ACAT I/IA programs and capabilities that have a potentially significant impact on interoperability in allied and coalition operations.

*Policy Impact: MDA no longer approves AoA Study Guidance*



# Implementation of WSARA

## Acquisition Strategies to Ensure Competition

- Acquisition strategy for **MDAPs** must describe measures to ensure competition, or option of competition, at both prime and subcontract level throughout life-cycle
- Measures may include (if cost effective):
  - Competitive Prototyping
  - Dual-sourcing
  - Unbundling of contracts
  - Funding of next-generation prototypes or subsystems
  - Modular, open-architectures
  - Built-to-print approaches
  - Acquisition of complete Technical Data Package (TDP)
  - Competition for subsystem upgrades
  - Licensing of additional suppliers
  - Program reviews to address competitive long-term effects of program decisions
- Strategy must document rationale for selection of subcontract tier or tiers, and indicate that primes must give consideration to sources other than the prime for development/ construction of major subsystems and components of major weapon systems

*Policy Impact: More detailed discussion of competition in acquisition strategy; planning for competition must provide small business with maximum practical opportunity to participate*



# Implementation of WSARA

## Competition & Considerations for O&S

- Acquisition strategy for Major Weapon Systems must describe plan for identifying/selecting source of repair
- MDA will ensure that, to the maximum extent practicable, and consistent with statutes, maintenance and sustainment contracts are competitively awarded, and
- Full consideration for contract award to all sources, to include sources that partner or subcontract with public or private sector repair activities

*Policy Impact: More detailed discussion of maintenance and sustainment strategy and contracting approach in the acquisition strategy for ACAT I and II programs.*





# Implementation of WSARA Competitive Prototyping

- Technology Development Strategy (TDS) for **MDAPs** shall provide for prototypes of the system or, if system prototype is not feasible, for prototypes of critical sub-systems before MS B approval
- MDA may waive if
  - Cost exceeds life-cycle benefits (constant year dollars), including benefits of improved performance and increased technological and design maturity
  - DoD would not be able to meet national security objectives without a waiver.
  - If waived, a prototype still must be produced before MS B approval if expected life cycle benefits exceed cost of the prototype, and production of prototype is consistent with national security objectives
- If MDA waives competitive prototyping for a MDAP congressional defense committees and Comptroller General must be notified NLT 30 days after the waiver

*Policy Impact: Unless waived under conditions described, competitive prototyping now a statutory requirement for **MDAPs***



# Implementation of WSARA

## Cost Estimation: Role of Director, CAPE

- Provides policies and procedures for conduct of all DoD cost estimates
- Reviews Component cost estimates/analysis conducted for MDAPs & MAIS
- Conducts ICE and cost analysis for MDAPs for which USD(AT&L) is MDA in advance of:
  - Certifications pursuant to 10 USC 2366a (MS A), 2366b (MS B), or 2433a (critical cost growth in MDAPs);
  - Any decision to enter LRIP or full rate production
  - As requested by USD(AT&L) or considered appropriate by DCAPE
- Conducts ICE and cost analysis for MAIS programs for which the USD(AT&L) is MDA in advance of:
  - Any report pursuant to 10 USC 2445c(f) (critical program changes)
  - As directed by DCAPE or requested by USD(AT&L)



# Implementation of WSARA

## Cost Estimation: Role of DCAPE, continued..

- Receives results of all cost estimates/analysis and associated studies conducted by Components for **MDAPS** and **MAIS**; has access to all DoD data necessary to review cost analyses and execute DCAPE responsibilities
- Participates in discussions of discrepancies related to **MDAP** and **MAIS** cost estimates and comments on deficiencies related to methodology or execution of the estimates
- Concurs with choice of cost estimate used to support the APB and in support of **MDAP** and **MAIS** requirements
- Participates in decisions to request multi-year contract for a **MDAP**
- States, along with Component cost agencies, confidence level used in establishing cost estimates for **MDAP** & **MAIS**, and if less than 80%, why

*Policy Impact: Adds requirement for ICE for **MDAPs** for which the USD(AT&L) is the MDA in advance of MS A Certification, Full Rate Production Decision, and in support of indicated certifications and reports. An ICE will be required for **MAIS** programs for which USD(AT&L) is the MDA only if there has been a Critical Change*



# Implementation of WSARA

## Dir, DT&E and Dir SE

- Role of Director, Developmental Test & Evaluation (DT&E)
  - Reviews and approves DT&E plan in the TES and TEMP for **MDAPs** and all programs on the OSD DT&E Oversight List
  - Monitors and reviews DT&E of **MDAPs**
  - Has access to all Component records and data necessary to carry out duties
- Role of Director, Systems Engineering
  - Reviews and approves the SEP for **MDAPs**
  - Has access to all Component records and data necessary to carry out duties

*Policy Impact: Dir, DT&E (instead of USD(AT&L) reviews and approves DT portion of the TES and TEMP; Dir, SE (instead of DUSD(A&T)) reviews and approves SEPs for all **MDAPs**.*



# Implementation of WSARA

## Performance Assessment & Root Cause Analysis

Role of the senior official for PARCA:

- Conduct performance assessments for **MDAPs** periodically or when requested by SECDEF, USD(AT&L), Secretary of Military Dept, or head of Defense Agency
- Conduct root cause analysis for **MDAPs** as required by 10 USC 2433a, or when requested by SECDEF, USD(AT&L), Secretary of Military Dept, or head of Defense Agency
- Advise acquisition officials on **MDAP** performance issues:
  - Prior to certification under 10 USC 2433a (critical cost growth in **MDAPs**);
  - Prior to entry into full-rate production; and
  - Upon consideration of decision to request authorization for multi-year procurement contract

*Policy Impact: Newly established position to perform required functions*



# Implementation of WSARA Performance Assessments

- Evaluate the cost, schedule, and performance of the program, relative to current metrics, performance requirements, and baseline parameters
- Determine the extent to which the level of program cost, schedule, and performance relative to established metrics is likely to result in the timely delivery of a level of capability to the warfighter that is consistent with the level of resources to be expended and to provide superior value to alternative approaches that may be available to meet the same requirement





# Implementation of WSARA Root Cause Analysis

Considers the underlying cause or causes for shortcomings in cost, schedule, and performance including the role, if any, of:

- Unrealistic performance expectations;
- Unrealistic baseline estimates for cost and schedule;
- Immature technologies or excessive manufacturing or integration risk;
- Unanticipated design, engineering, manufacturing, or integration issues arising during program performance;
- Changes in procurement quantities;
- Inadequate program funding or funding instability;
- Poor performance by government or contractor personnel responsible for program management;
- or any other matters.



# Implementation of WSARA

## Assessment of **MDAP** Technologies

Director of Defense Research and Engineering (DDR&E) shall:

- Independently review, assess, and report on the technological maturity of **MDAP** technologies in support of MS B reviews, associated statutory certifications, and at other times designated by the USD (AT&L).
- Develop knowledge-based standards against which to measure the technological maturity and integration risk of critical technologies at key stages in the acquisition process for the purposes of conducting the required reviews and assessments of **MDAPs**.

*Policy Impact: DDR&E to independently review, assess, and report the maturity of **MDAP** technologies prior to MS B Certification. Also, DDR&E will develop standards that will be used to measure and assess the maturity of critical technologies and integration risk in **MDAPs**.*



# Implementation of WSARA Preliminary Design Reviews (PDR)

- PDRs before MS B are mandatory for all **MDAPs**
  - Reflected in Technology Development Strategy (TDS) to be approved by the MDA at MS A.
  - Post-PDR assessments conducted in association with MS B preparations and will be considered by the MDA at MS B certification review.
- PDRs before MS B for other than **MDAPs** will be approved by the MDA when consistent with TDS or Acquisition Strategy objectives.
  - PDR conducted before MS B: a post-PDR assessment will be conducted in association with MS B review
  - PDR conducted after MS B: the MDA will conduct a post-PDR assessment at a time reflected in the approved Acquisition Strategy.

*Policy Impact: PDR before MS B is statutory requirement for **MDAPs**. Post-PDR Assessment will be conducted during MS B review, and prior to 2366b certification.*



# Implementation of WSARA Program Certifications IAW 10 USC 2366a and 2366b

- Requirements for MDA program certification at Milestone A (10 USC 2366a) and MS B (10 USC 2366b) were amended
- Ongoing **MDAPs** initiated prior to 22 May 2009 and will not have received a MS A certification or MS B certification prior to May 22, 2010, must receive a MS A certification NLT May 22, 2010
- Any **MDAP** that received a MS B approval prior to January 6, 2006, and has not yet received a MS C approval, the MDA, not later than February 16, 2010, must determine whether or not such programs satisfy all of the MS B certification requirements, as amended by WSARA. This determination will be documented in a “for the record” MS B certification memorandum

*Policy Impact: The MS A and MS B Certification requirements have changed. Required statements for the ADM, and changes to the certification statements are highlighted on following charts.*



# Implementation of WSARA Program Certifications IAW 10 USC 2366a and 2366b

Following statements must be added to the ADM:

MS A: "I have reviewed the program and have made the certifications required by Section 2366a of Title 10, United States Code. At any time prior to Milestone B approval, the Program Manager shall notify me immediately if the projected cost of the program exceeds the cost estimate for the program at the time of Milestone A certification by at least 25 percent or the PM determines that the period of time required for the delivery of an initial operational capability is likely to exceed the schedule objective provided at the time of Milestone A certification by more than 25 percent."

MS B: "I have reviewed the program and the business case analysis and have made the certifications required, or executed a waiver of the applicability of one or more of the components of the certification requirement as authorized by Section 2366b of Title 10, United States Code. The Program Manager shall notify me immediately of any changes to the program that alter the substantive basis for the certification relating to any component of such certification, or otherwise cause the program to deviate significantly from the material provided to me in support of such certification."





# Implementation of WSARA Program Certification for MS A (10 USC 2366a)

## MEMORANDUM FOR THE RECORD

### SUBJECT: Milestone A Program Certification

As required by Section 2366a of Title 10, United States Code, I have consulted with the Joint Requirements Oversight Council (JROC) on matters related to program requirements and military needs for the *(name of program)* and certify that:

- (1) the program fulfills an approved initial capabilities document;
- (2) the program is being executed by an entity with a relevant core competency as identified by the Secretary of Defense;
- (3) *an analysis of alternatives has been performed consistent with the study guidance developed by the Director of Cost Assessment and Program Evaluation;*
- (4) a cost estimate for the program has been submitted, *with the concurrence of the Director of Cost Assessment and Program Evaluation*, and the level of resources required to develop and procure the program is consistent with the priority level assigned by the JROC; and,
- (5) *[include only if the system duplicates a capability already provided by an existing system]* the duplication of capability provided by this system is necessary and appropriate.



# Implementation of WSARA Program Certification for MS B (10 USC 2366b)

## MEMORANDUM FOR THE RECORD

### SUBJECT: Milestone B Program Certification

As required by Section 2366b of Title 10, United States Code,

(1) I have received a business case analysis for the (*name of program*) and certify on the basis of the analysis that:

(A) the program is affordable when considering the ability of the Department of Defense to accomplish the program's mission using alternative systems;

(B) *appropriate trade-offs among cost, schedule, and performance objectives have been made to ensure that* the program is affordable when considering the per unit cost and the total acquisition cost in the context of the total resources available during the period covered by the future-years defense program submitted during the fiscal year in which the certification is made;

(C) reasonable cost and schedule estimates have been developed to execute, *with the concurrence of the Director of Cost Assessment and Program Evaluation*, the product development and production plan under the program;

(D) funding is available to execute the product development and production plan under the program, through the period covered by the future-years defense program submitted during the fiscal year in which the certification is made, consistent with the estimates described in paragraph (C) for the program; and

(2) *I have received the results of the preliminary design review and conducted a formal post-preliminary design review assessment, and certify on the basis of such assessment that the program demonstrates a high likelihood of accomplishing its intended mission*; and



# Implementation of WSARA Program Certification for MS B (10 USC 2366b), continued..

(3) I further certify that:

- (A) appropriate market research has been conducted prior to technology development to reduce duplication of existing technology and products;
- (B) the Department of Defense has completed an analysis of alternatives with respect to the program;
- (C) the Joint Requirements Oversight Council has accomplished its duties with respect to the program pursuant to section 181(b) of Title 10, including an analysis of the operational requirements for the program;
- (D) the technology in the program has been demonstrated in a relevant environment, *as determined by the Milestone Decision Authority on the basis of an independent review and assessment by the Director of Defense Research and Engineering; and*
- (E) the program complies with all relevant policies, regulations, and directives of the Department of Defense.

Changes highlighted in *bold blue italics*



# Implementation of WSARA Critical Cost Growth (1)

DTM contains policy implementing new 10 USC 2433a, Critical Cost Growth of **MDAPs**, that amends 10 USC 2433, Unit Cost Reports, and supersedes all previous USD(AT&L) policies addressing actions that must be taken following critical cost growth of a **MDAP** or designated subprogram

- PM shall notify the CAE immediately, whenever there is a reasonable cause to believe that the current estimate of either the program acquisition unit cost (PAUC) or average procurement unit cost (APUC) of a **MDAP** or designated subprogram (in base-year dollars) has increased by 25 percent (or more) over the PAUC or APUC objective of the currently approved APB estimate, or 50 percent (or more) over the PAUC or APUC of the original APB estimate.
- If the CAE determines that there is an increase in the current estimate of the PAUC or APUC of at least 25 percent over the PAUC or APUC objective of the currently approved APB, or 50 percent over the PAUC or APUC of the original APB, the CAE shall inform the USD(AT&L) and the Head of the DoD Component.



# Implementation of WSARA

## Critical Cost Growth (2)

- If the Component Head subsequently determines that there is, in fact, an increase in the current estimate of the PAUC or APUC of at least 25 percent over the currently approved APB, or 50 percent over the PAUC or APUC of the original APB, the Head of the DoD Component shall notify Congress, in writing, of the determination of critical cost growth and the increase with respect to the program or subprogram concerned.
- The notification shall be not later than 45 days after the end of the quarter, in the case of a quarterly report; or not later than 45 days after the date of the report, in the case of an out-of-cycle report based on critical change occurring between quarters. In either case, notification shall include the date that the Head of the DoD Component made the determination.
- In addition, the Component Head shall submit an SAR for either the fiscal year quarter ending on or after the determination date, or for the fiscal year quarter that immediately precedes the fiscal year quarter ending on or after the determination date. This SAR shall contain the additional critical cost growth-related information.





# Implementation of WSARA

## Critical Cost Growth (3)

- The USD(AT&L), after consultation with the JROC, shall determine the root cause or causes of the critical cost growth in accordance with applicable statutory requirements and DoD policies, procedures, and guidance based upon the root cause analysis conducted by the senior official for PARCA; and in consultation with the DCAPE, shall carry out an assessment of:
  - a. The projected cost of completing the program if current requirements are not modified.
  - b. The projected cost of completing the program based on reasonable modification of such requirements.
  - c. The rough order of magnitude of the costs of any reasonable alternative system or capability.
  - d. The need to reduce funding for other programs due to the growth in cost of the program.



# Implementation of WSARA

## Critical Cost Growth (4)

- After conducting the reassessment, the USD(AT&L) shall terminate the program unless the USD(AT&L) submits a written certification to Congress before the end of the 60-day period beginning on the day the SAR containing the unit cost information is required to be submitted to Congress. The certification must state:
  - a. The continuation of the program is essential to the national security.
  - b. There are no alternatives to the program that will provide acceptable capability to meet the joint military requirement (as defined in section 181(g)((1) of Title 10, U.S.C) at less cost.
  - c. The new estimates of the PAUC or APUC have been determined by the DCAPE, to be reasonable.
  - d. The program is a higher priority than programs whose funding must be reduced to accommodate the growth in cost of the program.
  - e. The management structure for the program is adequate to manage and control PAUC or APUC.



# Implementation of WSARA

## Critical Cost Growth (5)

- The written certification shall be accompanied by a report presenting the root cause analysis and assessment and basis for each determination made in accordance with the five certification criteria listed previously
- If the USD(AT&L) elects NOT to terminate a **MDAP** that has experienced critical cost growth, the Secretary of Defense shall:
  - a. Restructure the program in a manner that addresses the root cause or causes of the critical cost growth, and ensures that the program has an appropriate management structure as set forth in the written certification;
  - b. Rescind the most recent milestone approval for the program or designated subprograms and withdraw any associated certification(s) pursuant to section 2366a or 2366b.
  - c. Require a new milestone approval for the program or designated subprograms before taking any contract action to enter a new contract, exercise an option under an existing contract, or otherwise extend the scope of an existing contract under the program, except to the extent determined necessary by the MDA, on a non-delegable basis, to ensure that the program can be restructured as intended by the Secretary of Defense without unnecessarily wasting resources.
  - d. Include in the report a description of all funding changes made as a result of the growth in cost of the program, including reductions made in funding for other programs to accommodate such cost growth. (The report specified here is the first SAR for the program submitted after the President submits a budget in the calendar year following the year in which the program was restructured.)



# Implementation of WSARA

## Critical Cost Growth (6)

- Additionally, for each **MDAP** that has exceeded the critical cost thresholds, but has not been terminated, the senior official for PARCA shall conduct semi-annual reviews until 1 year after the date a new milestone approval is received. The senior official for PARCA, shall report the results of the semi-annual reviews to the USD(AT&L) and summarize the results in the Director's next annual report.
- If a **MDAP** is terminated after experiencing a critical cost breach, the USD(AT&L) shall submit to Congress a written report with the following information:
  - a. An explanation of the reasons for terminating the program.
  - b. The alternatives considered to address any problems in the program.
  - c. The course the Department of Defense plans to pursue to meet any continuing joint military requirements otherwise intended to be met by the program.



# Implementation of WSARA Revised **MDAP** Definition

A **MDAP** is a Department of Defense acquisition program that is not a highly sensitive classified program and:

- a. that is designated by the USD (AT&L) as an **MDAP**; or
- b. that is estimated to require an eventual total expenditure for research, development, test, and evaluation, *including all planned increments\**, of more than \$365M (based on fiscal year 2000 constant dollars) or an eventual total expenditure for procurement, *including all planned increments\**, of more than \$2.19B (based on fiscal year 2000 constant dollars).

*\*Change to definition highlighted in blue italics*

*Policy Impact: The revised definition may result in a change in MDA*



# Other WSARA Changes Not Directed by the DTM

- The organizational changes required by WSARA sections 101 and 102 were implemented in the following memos:
  1. DEPSECDEF Memorandum for Distribution, subject: Initial Implementation Guidance for the Office of the Director of Cost Assessment and Program Evaluation, 9 Jun 2009. Directed establishment of new Presidentially appointed, Senate confirmed position and transferred all functions of the Office of the Director of Program Analysis and Evaluation to the new office.
  2. USD(AT&L) Memorandum for OUSD(AT&L) Component Heads, subject: Organizational Changes, 23 Jun 2009. Implemented move of SE and DT&E from DUSD(A&T) to DDR&E.
  3. DDR&E Memorandum for Offices of the DDR&E, subject DDR&E Reorganization, 21 Aug 2009. Directed internal realignments for DDR&E.
- The role of the COCOM Commanders in identifying joint military requirements (section 105) was implemented in the 31 July 2009 version of the JCIDS Manual





# PPBE Memorandum

Deputy Secretary of Defense Memorandum: Procedures and Schedule for Fiscal Year (FY) 2012-2016 Integrated Program Budget Review, April 9, 2010.

This is déjà vu pre-1986 Biannual Budget Legislation and will impact most of DAU classes, the "Wall Chart", the PM Tool Kit, etc.

- Back to an annual review with 5 year cycles.
- One year budget every year; no two year budget (no on/off or odd/even)
- Program Budget Decisions (PBD) are now Requirement Management Decisions (RMD)
- Guidance for the Defense of the Forces (GDF) and Joint Programming Guidance (JPG) combined into Defense Planning and Programming Guidance (DPPG)
- POM due in July; BES due in Sep

**DoD has not yet issued implementation information**



# Sec. 804 FY 2010 NDAA - Implementation of New Acquisition Process for IT Systems

- New IT Acquisition Process Required
  - SECDEF shall develop/implement a new IT Systems acquisition process
  - The acquisition process must be based on the recommendations in Chapter 6, March 2009 report of the Defense Science Board Task Force on DOD Policies and Procedures for the Acquisition of Information Technology; and be designed to include—
    - early and continual involvement of the user
    - multiple, **rapidly executed** increments or releases of capability
    - early, successive prototyping supporting an evolutionary approach &
    - a modular, open-systems approach
- REPORT - SECDEF shall submit to Congress a report on the new acquisition process NLT 270 days from the enactment of the act.



# IMPROVE Acquisition Act of 2010

House Armed Services Committee Chairman Ike Skelton(D-Mo.) and Ranking Member Howard P. "Buck" McKeon (R-Calif.) joined the Committee's Defense Acquisition Reform Panel Chairman Rob Andrews (D-N.J.) and Ranking Member Mike Conaway (R-Texas) to announce the introduction of H.R. 5013 (April 14<sup>th</sup>, 2010) <http://armedservices.house.gov/pdfs/HR5013/HR5013.pdf>, the IMPROVE Acquisition Act, bipartisan legislation to overhaul defense acquisition spending, potentially saving billions of taxpayer dollars and expediting the process to get the necessary equipment to our warfighters.

The legislation is based on the recommendations outlined in the final report <http://armedservices.house.gov/pdfs/DARFINALREPORT/DARFINALREPORT032310.pdf> of the Defense Acquisition Panel



# **\*IMPROVE Acquisition Act of 2010**

\*Implementing Management for Performance and Related Reforms to Obtain Value in Every Acquisition Act of 2010 (IMPROVE)

Three Titles in the Legislation:

Title I – Defense Acquisition System

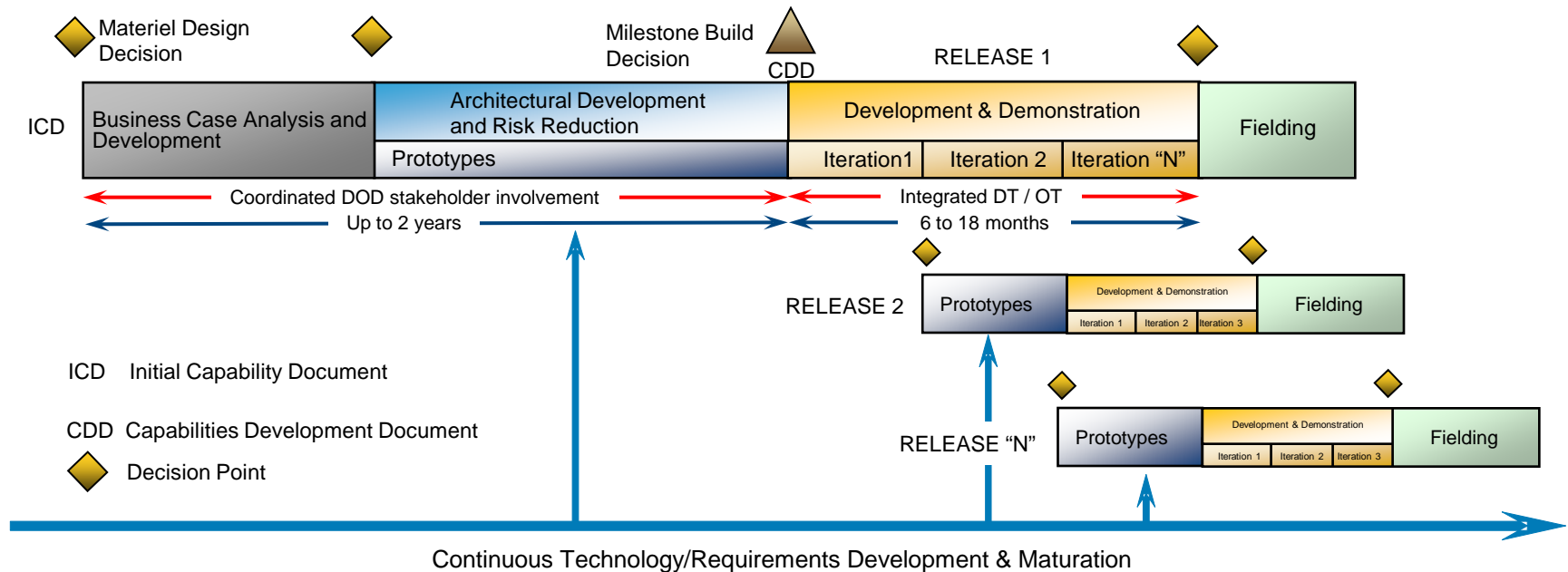
Title II - Defense Acquisition Workforce

Title III – Financial management

Title IV – Industrial Base



# Proposed Information Technology Acquisition Life Cycle Model (DSB)



ICD established by streamlined JCIDS process

CDD and acquisition baseline for "N" releases established at milestone build decision

All releases fully funded at milestone build decision

Release "N+1" restarts entire process

**Adapts an Evolutionary Approach to IT Acquisition**

# Proposed Space Model (NSS 03-01)



## Key PM Topic Areas for KDP Preparation (Details on back side of chart)

**Objectives:**  
Develop & document a systems engineering process for developing pre-AoA materiel solutions  
Validate the process using a case study with a stated capability shortfall & document the results

**Deliverables:**  
Systems Engineering Plan specifically tailored for pre-AoA materiel concepts  
Characterization & technical data of the materiel solutions developed for the stated capability shortfall

### Solution Identification

4 of options reduced from 1000 + Pre KDP A to final solution by KDP B

### Key Activities

Flow Diagrams Describing Major Activities and their relationships

## Concept Characterization

### Technical Systems Engineering Test & Evaluation Supportability

**Oversight & Review Acronyms**

ADM – Acquisition Decision Memorandum  
AoA – Analysis of Alternatives  
APB – Acquisition Program Baseline  
CD – Concept Decision  
DAB – Defense Acquisition Board  
DSAB – Defense Space Acquisition Board  
ESOH – Environment, Safety & Occupational Health  
EVM – Earned Value Management

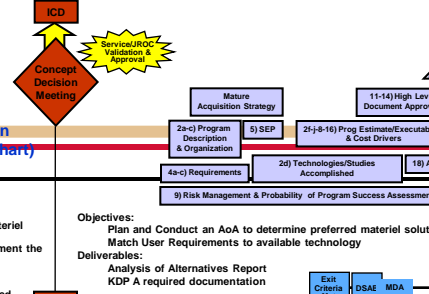
IBR – Integrated Baseline Review  
ITAB – Information Technology Acquisition Board  
MDA – Milestone Decision Authority  
MOSA – Modular Open Systems Approach  
PSR – Program Support Review  
T&E – Test and Evaluation  
TLCSM – Total Life Cycle Systems Management

**Cost Acronyms**

CARD – Cost Analysis Requirements  
Description  
CCA – Component Cost Assessment  
ICE – Independent Cost Estimate

POE – Program Office Estimate  
PMO – Program Management Office  
RD&E – Research, Development, Test & Evaluation

## Pre KDP-A Concept Studies

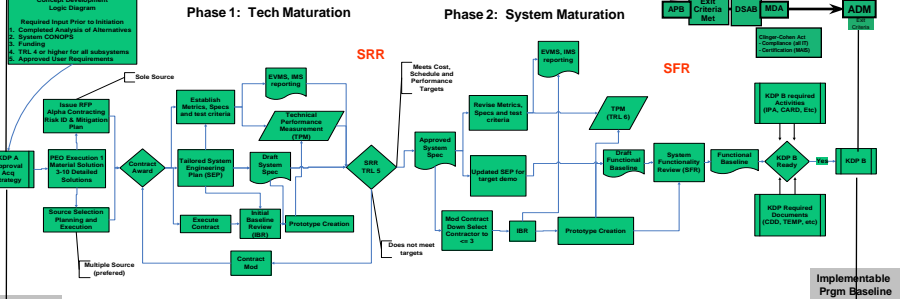


## KDP A

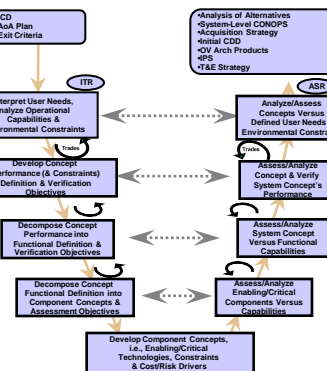
**Objectives:**  
Mature Technologies to TRL 6  
Develop a firm, cost effective program baseline meeting user requirements

**Deliverables:**  
Approved System Specification and Function Baseline (Note: Key NSS 03-01 requirement that differs from DoD 5000)  
KDP B required documentation (see reverse side)  
Planning must allow time and schedule for iterative technology development – Maturing technology may not achieve SRR or SFR criteria on first attempt

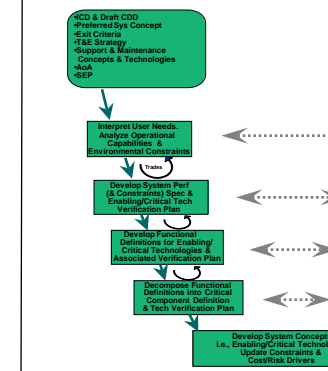
## KDP B



## Preferred System Concept



## Tech Demonstrations & Prototypes

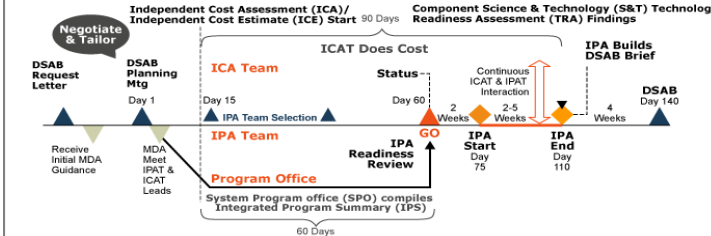


## Key Management Considerations

Program Structure  
Acquisition Approach  
Capability Needs  
Corrosion Prevention  
Data Management  
Life Cycle Sustainability  
T&E Considerations  
Risk Management  
Resource Management  
Systems Engineering  
Information Technology

Inter-operability  
Research & Tech Protection  
Information Assurance  
Product Support  
Human Systems Integration  
ESOH  
MOSA  
Business Considerations  
Best Practices  
Relief, Exemptions & Waivers

## DSAB and IPA Readiness Process



## Technical & Logistics Acronyms

ASR – Alternative Systems Review  
CDD – Capability Development Document  
CI – Configuration Item  
CRA – XXXXXXXX  
DOTMLPF – Doctrine, Organization, Training, Manpower, Leadership, Personnel and Facilities  
DT&E – Development Test & Evaluation  
ESOH – Environmental, Safety & Occupational Health  
ICD – Initial Capabilities Document  
IPA – Independent Program Assessment  
IPS – Independent Program Summary  
ISR – In-Service Review  
ISRP – Information Support Plan  
ITR – Initial Technical Review  
JROC – Joint Requirements Oversight Council

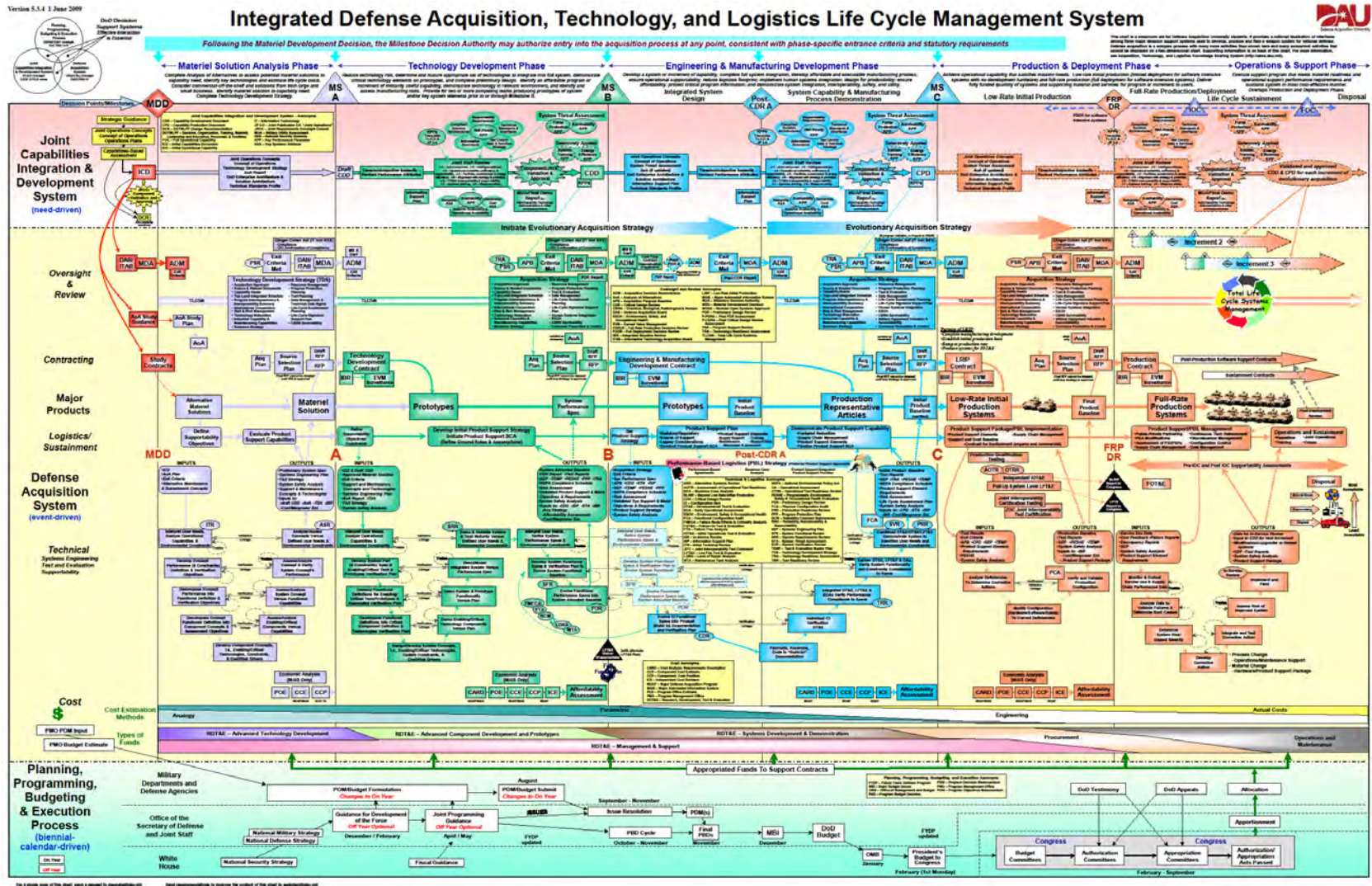
KDP – Key Decision Point  
KPP – Key Performance Parameter  
PESHE – Programmatic Environment, Safety & Occupational Health Evaluation  
PPP – Program Protection Plan  
RMS – Reliability, Maintainability & Supportability  
SEP – Systems Engineering Plan  
ESOH – System Threat Assessment  
SFR – System Verification Review  
T&E – Test & Evaluation  
TEMP – Test & Evaluation Master Plan  
TRA – Technology Development Strategy  
TDS – Technology Readiness Assessment



## 40



# Weapons Systems Acquisition Life Cycle Model





# Acquisition of Services



*Acquisition of services are often conducted by personnel unfamiliar with concepts of performance based acquisition*  
**Established in January 2010**



# Acquisition and Program Management Knowledge Sharing Initiatives

## Program Management CoP



### PM

- Lifetime page views 13,2063,618
- 1,480,088 page views FY10 to date
- 3,397 members
- Available 24/7

## Risk CoP



### Risk

- Lifetime page views 6,259,343
- 412,892 page views FY10 to date
- 535 members
- Available 24/7

## Space CoP



### Space

- Established January 21<sup>st</sup>, 2010
- Available 24/7

Lifetime page views reflect time period AUG 06 to present (1/13/10)



# Acquisition and Program Management Knowledge Sharing Initiatives

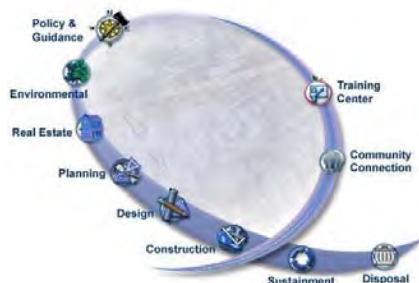
## Acquisition Law CoP



### Acquisition Law

- Lifetime page views 391,252
- 85,295 page views FY10 to date
- 42 members
- Available 24/7

## Facilities CoP



### Facilities

- Lifetime page views 838,249
- 81,897 page views FY10 to date
- 148 members
- Available 24/7

## International PM CoP



### International PM

- Lifetime page view 994,255
- 82,396 page views FY09 to date
- 109 members
- Available 24/7

Lifetime page views reflect time period AUG 06 to present (1/13/10)



# Acquisition and Program Management Knowledge Sharing Initiatives

## Program Managers e-Tool Kit



### PM e-Tool Kit

- Lifetime page views 183,815
- 165,213 page views FY10 to date
- Available 24/7

Launched OCT 09





**Presented to: NDIA Joint Armaments Conference**

Dallas, Texas

May 17, 2010

## **International Traffic in Arms Regulations Government and Corporate Perspectives**

**Larry E. Christensen, *Esq.***  
**Member, Miller & Chevalier Chartered**  
**202-626-1469 (office direct)**  
**571-275-6999 (cell)**  
**[lchristensen@milchev.com](mailto:lchristensen@milchev.com)**

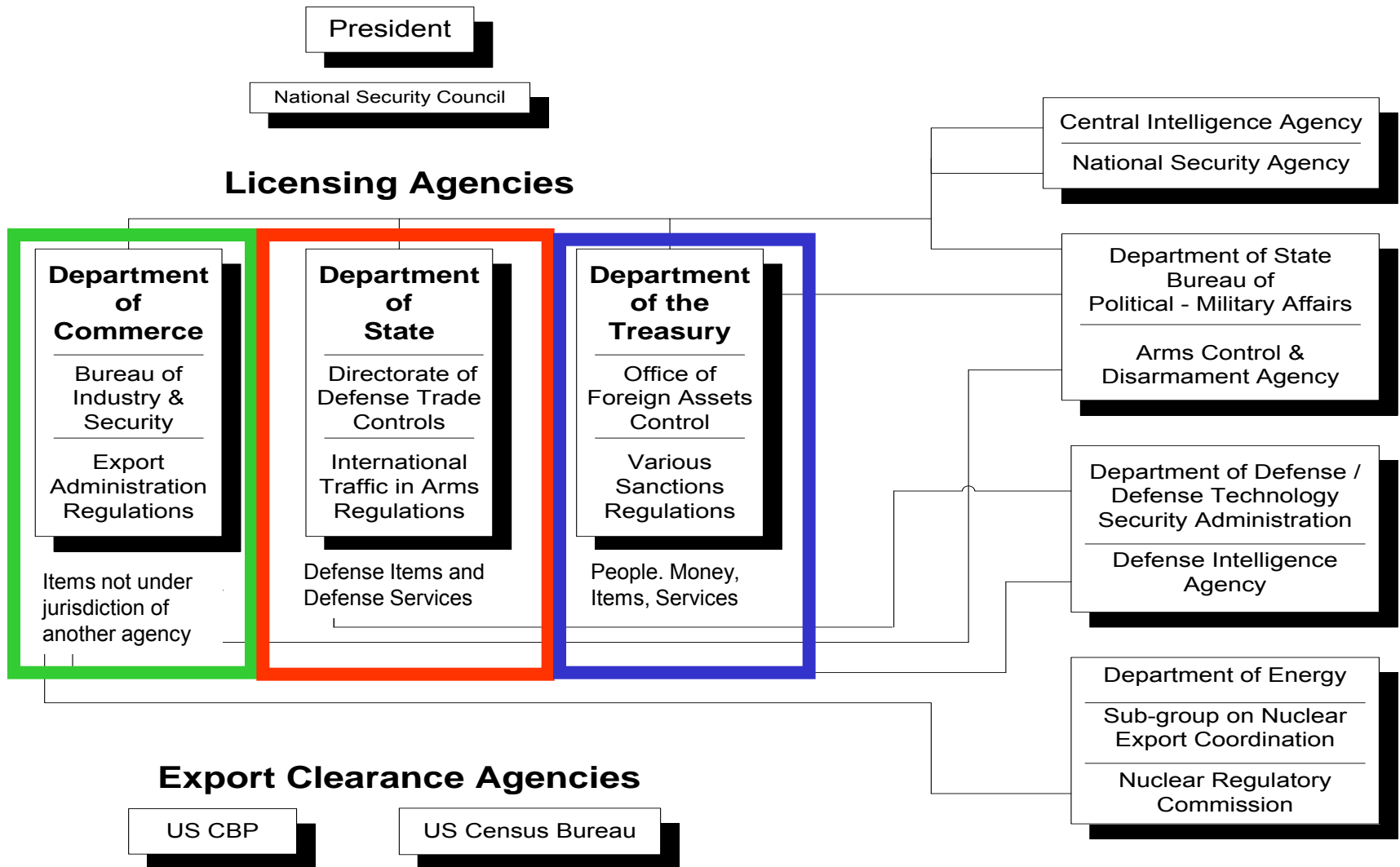
# Introduction

- I do not work for the USG, it will just sound like that explaining the rules in plain English
- You can manage your business effectively under the ITAR
- You have heard the basics, and now we will dig deeper into how to manage your complex supply chain while achieving compliance, profits, satisfied customers and employees proud of your companies.
- You can do this. You can plan your affairs with DDTC, properly set the expectations of you non-U.S. customers, meet the requirements under the ITAR, give DDTC there due, and prove to your customers that you are a compliant company that can be proud to do business with.

# Who is in the group by show of hands?

- Sales or marketing
- Engineering
- Compliance
- U.S.
- Non-U.S.
- Holding Classified Facilities
- More than five years of experience with the International Traffic in Arms Regulations (ITAR)
- More than two years
- More than one
- Clueless or in the wrong seminar

# U.S. Export Control System – Regulations and Agencies



# The ITAR Licensing Life Cycle

## From Go to Market to Contract Completion

- Creation of the distribution system
- Trade shows
- Engineering discussions generally
- Requests for Proposals
- Presentations and proposals
- Demonstrations and test firing
- Meetings hosted and/or required by DOD
- Defense services
- Permanent export of defense articles under DSP-5s
- Returns for repairs or calibration

# Engineering discussions--pitfalls under the ITAR:

- Engineering discussions present the biggest challenge for compliance officers.
- DOD program officers do not understand the ITAR.
- Foreign firms set RFP response deadlines too short to permit a U.S. exporter to obtain a TAA or authority to make a presentation or proposal for SME (all firearms and guns).
- Marketing and sales think they can get away with oral discussions re engineering, but that is not permitted.
- Foreign competitors to foreign potential buyers may already have a license before you, a U.S. firm, even realize you need one.



# Lessons in dealing with DOD program officers:

- If they ask you to make technical presentations or demonstrations to foreign persons, simply do not.
- Learn to decline diplomatically and blame the State Department and your compliance lawyers:
  - Colonel, we are ready and able to provide that information to your guests from [fill in the name of the country] once we have an ITAR license in hand. We do not want a violation of the ITAR to taint the program and individuals working on the program we all support. If we had been informed of this request a few weeks ago, we could have gotten permission from the Directorate of Defense Trade Controls (DDTC). We can accomplish our goals and yet give DDTC their due.

## Lessons in dealing with DOD program officers (cont):

- Program officers do not speak for the Directorate of Defense Trade Controls, not even colonels and generals. If they doubt that, give them the contact information for DDTC.
- If they persist rudely, give them the phone number at the DDTC response team, and let them have their spat with DDTC.
- There are a few DOD license exceptions under the ITAR but only 3 people in the entire Pentagon can approve them; and your project officer is not one of them even if he has stars on his shoulders.

# Lessons for non-U.S. companies in the RFP process:

- Recognize your U.S. bidder needs time to get authority to provide some of the information required by your Request For Proposal.
- Set response times sufficient for the U.S. bidder to obtain authority from DDTC (the times have come down dramatically over the last year, but preparation time and the current review time add up to many weeks--it used to be many months).

# Lessons for U.S. suppliers in the RFP process:

- The response to the RFP must either:
  1. Not contain any controlled technical data (ITAR or EAR), AND  
For SME must not be a detailed presentation or proposal ,  
or
  2. Obtain a DSP-5 Technical Data Marketing License or TAA that authorizes release of the controlled technical data , and, if SME, permission to present a detailed presentation or proposal sufficient for the potential buyer to determine to accept whether to enter into a TAA.

## Lessons for U.S. suppliers in the RFP process (cont.):

- Obtain a DSP-5 Technical Data Marketing License early for all potential customers and countries. Regularly update the list of potential customers, countries, and marketing messages.
- Publish on your website your marketing messages, capabilities, and offerings after review with compliance counsel and review of government limitations on disclosure. See public domain discussion below and DO NOT provide a defense service with public domain information or EAR-controlled information without first obtaining a Technical Assistance Agreement.

# When can we have engineering discussions:

- When authorized in a DSP-5 TDML.
- When authorized in a Technical Assistance agreement.
- When the discussion is no more than specific information published about your capabilities and offerings.
- When all the information is in the public domain both in individual messages and when taken as a whole & you do not provide a defense service.
- A DSP-5 may authorize a one-way export; not discussion.
- I know engineers are trained and paid to solve problems.
- But DDTC's goal is to prevent solutions for bad guys, untrustworthy parties, and parties without constraints on retransfer. Your unauthorized engineering discussions do not meet one or more of those goals.



# Trade show, demonstrations, and firing tests:

- Obtain DSP-73 for temporary export:
- Follow the guidelines for fire arms and ammunitions.
- If the trade show and item are previously licensed, then use license exemption for a second or third show if such is defined in the license. It is not a blanket trade show license exception.
- Do not combine a marketing license request and a trade show request. Some times you can combine marketing and test firing and some times you cannot.
- Technical data disclosed at trade shows is often in the public domain. However, see discussion below re public domain, defense services, and presentations and proposals.

# DDTC Guidance:

- Guidelines for the “Permanent Export, Temporary Export, and Temporary Import of Fire Arms and Ammunition, U.S. Munitions List Categories I and III”
  - Discussion of the sample checklist at pages 12 to 15.
  - Record this title so you may look it up on the Internet for updates. The recent changes to improve the DDTC website eliminated the search function, and this document and others are now difficult or impossible to find.

# Defense Services defined:

- TAA is required for Defense Service, including:
  - Service provided with publicly available technical data or EAR-technical data,
  - Military training, and/or
  - Transfer of ITAR-controlled technical data.
- Do not turn a response to an RFP into:
  - An unauthorized engineering discussion,
  - An unauthorized sales presentation or proposal, or
  - A defense service.

# Public domain treatment & the defense services pitfalls:

- Public domain treatment is available for information released at a trade show, presentation, or in any other context EXCEPT PROVIDING A DEFENSE SERVICE.
- Do not publish technical data or software without checking contracts with DOD. Note that for DOD related TD, release into the public domain often requires approval from the Office of Security Review (formerly known as of Office of Freedom of Information) and Security Review or from the Cognizant Security Agency.
- DDTC argues that some information is not “in a public library” and is not published just because it is on the Internet. DDTC says that if you sit at a terminal in a public library and go on the Internet, the technical data is not “in” the library.

# The Export Administration Regulations:

- This is a seminar about coping with the ITAR. However, there are licensing requirements under the Commerce Control List for:
  - Defined gun making machinery (see ECCN 2B018) if the items are not subject to the ITAR, and
  - Certain shotguns with a barrel length of 18 inches or greater (see ECCN 0A984)

# Commodity Jurisdiction

- Category II(g) for equipment and tooling to make gun is subject to the ITAR.
- It conflicts with ECCN 2B018 of the CCL.
- The ITAR prevails over the CCL.
- Never rely upon a commodity classification performed by BIS to determine agency jurisdiction. Only the State Department can determine the scope of its jurisdiction.



## The see-through rule:

- If you sell parts, be prepared to answer the commodity jurisdiction certifications to your commercial customers of parts.
- Some items designed for military applications under the design intent standard have commercial applications. They remain subject to the ITAR even when incorporated into commercial items.

# The Munitions Parts Incorporated into Munitions items

- What do these two items have in common?



- This little \$1,500 part (QRS-11)

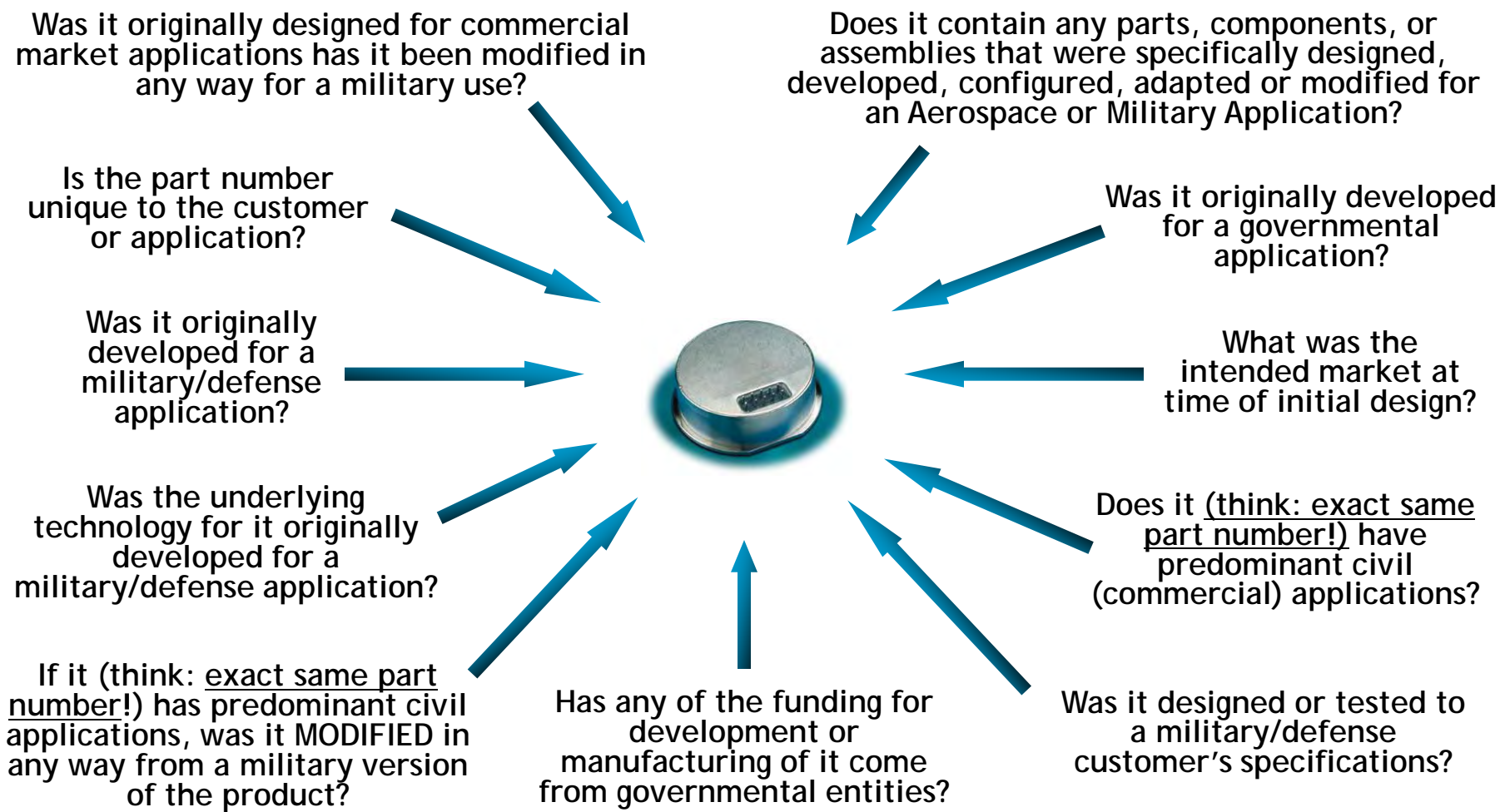
Quartz Rate Sensor



- *What is the consequence?* Commercial items may be considered munitions and subject to stringent export controls (for example export of QRS-11s were prohibited under the ITAR—at least until a jurisdictional change in the regulations just for certain QRS-- applications)

# Jurisdiction Determination Analysis

## Some of the Things to Consider



## Value:

- The ITAR calls for the arms length value the exporter will receive in payment from the direct buyer abroad.
- The same standard applies for the Export Declaration to the Bureau of the Census via your filing with Customs and Border Protection for each export.
- Recognize the need for a signature from the ultimate non-U.S. government on the DSP-83 will result in the in-country contractor's markup becoming known.
- Discussion of the issues surrounding procurement by the Japanese MOD.
- Do not give your compliance people the amount paid by the end user. Give the price paid to you by your immediate buyer.

# Coatings--manufacturing versus defense service or overlap:

- Example of a grey area requiring some guidance.
- Typically, DDTC views coating in the U.S. of non-U.S. munitions parts (aircraft parts, satellite parts, and gun parts) to be a defense service.
- The ITAR require a TAA for any defense service for a foreign person.
- However, at least for aircraft parts, DDTC usually will accept a DSP-5, and that requires less paper work and less review time.
- What of gun parts?

## Returns and repairs:

- Temporary returns to the United States of items subject to the ITAR require:
- Specific entry descriptions on the foreign firm's commercial invoice to inform the U.S. import authorities of the reliance upon an ITAR license exception for such a temporary import and special information from the importer of record upon import into the United States.
- Export declaration claiming the right to use an ITAR license exception for return of the repair or recalibrated item.
- Compliance with the limitations of the license exception.



## U.S. manufacturers who do not export:

- You have to register with DDTC as a manufacturer under the ITAR even if you do not export.

# What if I just export to Canada?

- You have heard of a Canadian exemption, but there is no Canadian exemption (among the many) that is a blanket exemption.
- You have to register under the ITAR to use any exemption.
- Canada is NOT the 51st State even though it is a close ally.
- Watch for the controlled goods program of Canada in addition to the DFAIT licensing requirements.

# Non-U.S. Firms & Other Rules:

- I am a non-U.S. firm, what else do I need to consider before investing in a U.S. maker of firearms, guns, or ammunition?
- There are three national security agencies you must consider.
  - Directorate of Defense Trade Controls (DDTC)
  - Committee on Foreign Investment in the United States (CFIUS)
  - Defense Security Service (DSS)

## Non-U.S. Firms & Other Rules (cont.):

- A U.S. registrant must report to DDTC 60 days in advance of the transfer of control to any non-U.S. company.
- You will need to organize a U.S. subsidiary and register with DDTC and provide this information to the target.
- The Committee on Foreign Investment in the United States (CFIUS) reviews investment in the U.S. with national security implications.
- An investment in a U.S. registrant always requires a CFIUS review. The reviews are not really voluntary because DDTC forces them.
- The list of information required is extensive and the questioning or vetting phase is intense.

## Non-U.S. Firms & Other Rules (cont.):

- You need to account for the CFIUS review in your acquisition agreements, the price of the acquisition, and the time necessary for review before you may close. Insist your deal counsel consult with national security counsel before signing any agreement or letter of intent.
- The Defense Security Service regulates classified facilities and classified contracts. It also regulates Foreign Ownership Control and Influence (FOCI) to avoid diversion of classified information to foreign persons and foreign corporations, including foreign owners.
- Mitigation agreements (a) usually put the majority of the board in the hands of persons approved by DSS, responsible to DOD, and with no prior involvement with the owners, and (b) prevents foreign management.

## So-called brokering and your supply chain:

- Foreign persons, including your wholly own-foreign subsidiaries, are required to register and seek certain approvals from DDTC for arranging sales and asset-based lending for U.S.-origin items subject to the ITAR.
- U.S. persons, in the U.S. or abroad, including your foreign unincorporated branches of a U.S. corporation, are required to register and seek certain approvals from DDTC for arranging sales and asset-based lending for U.S. and foreign-origin items described on the USML but not subject to the ITAR because there are no U.S.-origin ITAR-controlled parts.
- DDTC is likely modifying the rule; however, it is not likely to reduce requirements in my judgment.



# The enforcement environment:

- Increased criminal actions against both large and small companies.
- Hundreds of voluntary disclosures to DDTC per year:
  - Almost completely eliminates criminal risks assuming a complete and accurate disclosure.
- While DDTC imposes substantial administrative fines in a handful of cases each year, it often directs self-audits (shared with DDTC) and requires responses and compliance steps that may be costly.
- Until this year, the high water mark for a criminal fine was \$100 million dollars and a multimillion dollar administrative fine against ITT. Their monitorship end in April of 2010.
  - The statement of facts by the U.S. attorney is riveting reading for business people. It is required reading.

## The enforcement environment (cont.):

- In 2010, the Department of Justice settled with BAE Systems UK for \$400 million for failure to report fees and commission required under the ITAR. The allegations were largely of bribes paid to government officials in other countries to obtain contracts to reexport defense articles and defense services subject to the ITAR.
- Department of Justice uses stings and fronts in export control matters, and those stings and fronts are similar to the Shot Show stings for allegations of the Foreign Corrupt Practices Act.

## The enforcement environment (cont.):

- Department of Justice arrests foreign persons for export control violation while in the U.S. on travel and is willing to seek extradition for export control violations.
- It is more likely than not to succeed in such efforts when the home country requires a license for the same items to the same ultimate country of destination.
- Department of Justice recently lost an extradition case in France regarding an Iranian for reexports to Iran because the export from France was not prohibited by its laws:
  - U.S. will seek extradition, and
  - For guns and armaments, there will usually be a local law violation that supports extradition.
- China is the greatest concern under the ITAR and licenses are prohibited and denied.

## General lessons and observations:

- Your business has a complex supply.
- The project life cycle requires DDTC approvals in many separate parts of that supply chain and often does not permit requests for a combination of authorities.
- The DSP-5 Technical Data Marketing License is a useful tool for marketing and detailed SME presentations and proposals.
- DDTC may soon eliminate the requirement for prior approval of such presentations and proposals; however, you will still need DDTC authority for the controlled technical data you wish to release in presentations and proposals.
- The enforcement environment is becoming more active, especially on the criminal side.

## General lessons and observations (cont.):

- You need compliance advisors in-house and/or outside. Keep them informed early and often. They can help you with your plans and help you properly set customer expectations but only if you communicate with them.
- The ITAR is a benefit. It enables you to trade with the blessing of the United States Government.
- You can do this. You can plan your affairs with DDTC, properly set the expectations of your non-U.S. customers, meet the requirements under the ITAR, and give DDTC there due.
- More importantly, your customers want to deal with responsible, compliant companies; and you can demonstrate that you fill the bill.



**Thank You.**

## **May I Take Your Questions?**

Larry E. Christensen, *Esq.*  
Miller & Chevalier Chartered  
202-626-1469  
Cell 571-275-6999  
[LChristensen@milchev.com](mailto:LChristensen@milchev.com)





# International Traffic in Arms (ITAR)

Mose Lewis, Consultant to EME

# What is the ITAR?

The Regulations that Rule Exports and Imports

Failure to Comply =

Fines

Debarment

Jail Time

# Scope of Presentation

- Introduction, Mission & Topics
- Department of State (DOS), Directorate Defense Trade Controls (DDTC)
- Defense Security Cooperation Agency (DSCA)
- Defense Technical Security Agency (DTSA)
- U.S. Army Security Assistance Agency (USASAC)
- Department of Commerce (DOC)

# Scope of Presentation (Cont.)

- Licensing
- Compliance
- Recent changes
- Helpers

# AGENCIES

DEPARTMENT OF STATE (DIRECTORATE DEFENSE  
TRADE CONTROLS)

DEPARTMENT OF COMMERCE

DEFENSE SECURITY COOPERATION AGENCY

DEFENSE TECHNOLOGY SECURITY AGENCY

USARMY SECURITY ASSISTANCE COMMAND

# BASICS

EXPORTERS MUST REGISTER – (DDTC)

MUST DESIGNATE AN “EMPOWERED OFFICIAL”

MUST SUBMIT LICENSE APPLICATIONS

MUST OBEY ITAR

# EXPORT CONTROL

## System of Licensing - Forms

DSP-5	Permanent Export
DSP-73	Temporary Export
DSP-61	Temporary Import
DSP-83	End Use Certificate
Certificate	of Empowered Official

Technical Assistance Agreement

Manufacturing Licenses Agreements



# When Does an Export Occur?

Obviously when shipping info, documents or items overseas.

May also create an export when:

- Talk or send emails to a foreign National

- Handout flyers at a trade show

- Create company web sites

- Give briefings when foreigners are present

- Carry company samples overseas

USG compliance is aimed at control of Technology

# Licenses

Clearly State who-what-when-where-why-how of export

- ❖ Provide relevant documents and where to go if additional info is needed
  - ❖ Have knowledgeable Governmental POC
  - ❖ Have relevant graphics, demonstrate logic for approval with relevant prior approvals
  - ❖ Define the Scope of Export:
    - State unequivocally what will not be exported

Courtesy of Navy IPO

# Characteristics of Poor Licenses

- ❖ Ask for everything, USG will tell us what we can't have)
  - ❖ Have conflicting statements, e.g. ,
    - Cover letter vs. support documents
- Have Government POC's who retired last year

Courtesy of Navy IPO

# Characteristics of Poor Licenses (Cont.)

- Use Soviet approach to supporting documentation:
  - “Quantity has quality all it’s own”
- Do not exhibit graphics, clarity, logic for release and on relevant prior approvals
- Don’t have anyone in the company who can answer questions.

Courtesy of Navy IPO

# What is Technical Data?

- + Classified Info on defense articles & services
- + Info covered by an invention secrecy order
- + Info in any form directly related to design, engineering, development, production, repair, of defense articles/systems
- + Blue prints, drawings, photos, etc.
- + Does not include general science, math, engineering taught in academia
- + Does not include marketing info on general defense systems

# RESEARCH & DEVELOPMENT

- Exchange of basic research not defense-specific does not require an export license
- Government financial program level of 6-2 is uncontrolled 6-3 is a gray area
- Dual use technology biased toward commercial application is controlled by DOC

# RESEARCH & DEVELOPMENT (Cont.)

- State makes the call whether defense or DOC
- National Academy of Sciences reports the issues
- Defense research is exportable with a TAA



# NATIONAL ACADEMY of SCIENCES REPORT

## (ON EXPORT CONTROL)

Current System is Broken – must be restructured

System harms National Security

Reduces economic prosperity

Many controls do not improve security

Best research is undermined by USG Regulations

Cannot fix the system below Presidential level

# RECOMMENDATIONS

A NEW COORDINATION CENTER  
AT NATIONAL SECURITY LEVEL –  
REVIEW LICENSES

APPEALS PANEL TO RESOLVE  
ISSUES

# Office of Inspector General

A review of DOS Munitions export license process found many deficiencies:

Two examples:

1. DDTC is inefficient & unnecessarily burdensome
2. Process lacks tracking resulting in lost or misplaced applications

# ITAR Problems

## (Two of Many)

The ITAR “TAINT” is one small component, like a radio mount, can result in a whole system falling under ITAR control

A space heater for an arctic tent is classified as “significant military equipment” and therefore cannot be moved to another country without an export license

# SEC DEF GATES REFORM THE ITAR

- PRESIDENT HAS DIRECTED REVIEW OF EXPORT CONTROL REGEME
- SYST. FAILED TO PREVENT EXPORT OF HARMFUL TECHNOLOGY
- WASTING RESOURCES CONTROLLING TECH AVAILABLE AT RADIO SHACK

# SEC DEF GATES

## REFORM THE ITAR (Cont.)

- EXPORT CONTROL OF SMALL PARTS OF A WHOLE SYSTEM ALREADY APPROVED
- TOO MANY AUTHORITIES, ROLLS, MISSIONS IN DIFFERENT PARTS OF USG
- CONFUSION ABOUT JURISDICTION

# SEC DEF GATES

## REMEDIES

- SINGLE EXPORT CONTROL LIST OF ONLY CRITICAL ITEMS
- SINGLE LICENSING AGENCY OVER MUNITIONS & DUAL USE ITEMS
- SINGLE ENFORCEMENT COORDINATION AGENCY
- SINGLE UNIFIED IT STRUCTURE TO REDUCE REDUNDANCY & WASTE
- CHANGES WILL REQUIRE CONGRESSIONAL ACTION



# RECENT CHANGES

- LICENSE PROCESSING – FASTER!
- ALL APPLICATIONS – ELECTRONIC
- STAFF INCREASED AT DDTC
- BROKERING REGISTRATION - CASE BY CASE
- IRAQ MOVING TOWARD U.S. EQUIPMENT/AMMO



# HELPERS

When you have questions – Don't know what to do,  
call for Help:

DDTC WEB Page – <http://pmddtc.state.gov>

DDTC Response Team – 202 663-1282

DSCA – Brett Floro 703 604-6626

DTSA – Patrick Merryman 703 325-4297

USASAC – Col. David Dornblaser 703 806-2292

SIA – Senior Advisor: Gregory Creeser, 703 597-2517

Email: <http://siaed.org/publications.cfm>

DOD INFO/Security – Donald Kluzic, 703 695-9580

EME Consultant – Mose Lewis, 703 534 5412

Email [mellew88@aol.com](mailto:mellew88@aol.com)



# ***NDIA Joint Armaments Conference, Dallas, TX***

---

## **Demystifying Intellectual Property and Data Rights: Government and Industry Perspectives**

Tim Ryan, U.S. Army RDECOM-ARDEC,  
Chief, Technology Transfer & International Cooperation  
Picatinny Arsenal, NJ

&  
Carlton Chen, Colt Defense LLC  
Vice President, Business and Regulatory Affairs  
West Hartford, CT

**May 17, 2010**

**Note:** The view expressed here are those of the speakers and do not necessarily reflect the views of their employers.



## TOPICS FOR DISCUSSION

---



- ❑ Why IP and Data Rights Are Important for the Government and Industry
- ❑ Types of IP and Key Definitions
- ❑ Range of IP Rights and Criteria for Applying Protection
- ❑ Asserting IP Rights
- ❑ FAR/DFARS Provisions
- ❑ Non-FAR Agreements
- ❑ Practical Examples
- ❑ References/Contacts/Concluding Remarks



# ***WHAT IS INTELLECTUAL PROPERTY?***

---

- ❑ **The term “Intellectual Property” means patents, copyrights, trademarks, and trade secrets.**
- ❑ **In dealing with IP rights, the Government has promulgated policies and regulations on patents, copyrights, technical data, and computer software**



# ***WHY IS INTELLECTUAL PROPERTY IMPORTANT?***

---

## ***Government Perspective***

- ❑ Part of acquisition strategy for life-cycle sustainment of DoD Systems
- ❑ Enables competition
- ❑ Protection against paying again for what the government already has rights to use

## ***Industry Perspective***

- ❑ Valuable form of intangible property that is critical to the financial strength of a business
- ❑ Maintains competitive advantage
- ❑ Enables return on investment and reward for risk





## TRUTH OR FICTION?

---

MYTH	FACT
The U.S. Government paid for the development and therefore owns the data	The U.S. Government does not “own data”. The U.S. Government takes rights or “license” to data. The scope of the U.S. Government license depends on the nature of the data, the relative source of funding and negotiation between the parties



# M4 CARBINE

---

EXCERPT FROM **DEFENSE NEWS**

## Army Will Open Competition for Carbine - As Soon As Congress Passes Budget

BY MATTHEW COX, ARMY TIMES

PUBLISHED: 30 SEP 12:43 EDT (16:43 GMT)

Soldiers could have a new carbine by 2012, unless a Congressional budget impasse slows it down.

The Army requested \$9.9 million for fiscal 2010, money needed to start the solicitation process for a competition that stands to draw dozens of small arms companies waiting for the chance to unseat the M4 as the Army's primary soldier weapon.

In July, the service **took control of the design rights to the M4 carbine** from its sole maker, Colt Defense LLC. The **transition of ownership of the M4 technical data package** marked the end of an era and Colt's exclusive status as the only manufacturer of the M4 for the U.S. military for the past 15 years.

The **transfer of the licensing agreement** also frees up the Army to give other companies a crack at a carbine contract....

Small-arms companies waiting for the chance to compete for the Army's next carbine view **Colt's loss of the M4 TDP** as a new beginning for the industry and for soldiers serving in Iraq and Afghanistan....



## **RECENT GOVERNMENT ACQUISITION STRATEGIES FOR IP**

---

### **10 USC 2320 amended per FY2007 National Defense Authorization Act**

- ❑ “The Secretary of Defense shall require program managers for major weapon systems and subsystems of major weapon systems to assess the long-term technical data needs of such systems and subsystems and establish corresponding acquisition strategies that provide for technical data rights needed to sustain such systems and subsystems over their life cycle.”
- ❑ This change in policy was based on reports of the GAO criticizing the DoD for obtaining insufficient rights in technical data to support its weapons systems over their entire life.
- ❑ This statute also amended 10 USC 2321(f) to reverse the presumption that technical data relating to a commercial item was developed at private expense.



## ***RECENT GOVERNMENT ACQUISITION STRATEGIES FOR IP (cont'd)***

---

### **10 USC 2320 amended per FY2009 National Defense Authorization Act**

- ❑ New section 10 USC 2320a requires the Secretary of Defense to issue policy guidance regarding negotiation of and acquisition of technical data rights of agreements that are not subject to the FAR, including other transactions (OT) and cooperative research and development agreements (CRADA)
- ❑ Requires PMs for major weapon systems developed under such agreements to assess the long-term technical data requirements



## ***RECENT GOVERNMENT ACQUISITION STRATEGIES FOR IP (cont'd)***

---

### **FY2010 ASA(ALT) policy**

- ❑ PEO/PMs of ACAT I and II programs shall prepare and submit a Data management Strategy (DMS) as part of their acquisition strategy. ACAT III programs are encouraged to comply with this same policy
- ❑ The DMS is the key to developing competitive acquisition and support alternatives
- ❑ With each contract, the assertions to rights in data must be solicited, reviewed and challenged
- ❑ The initial Government position on the rights in data issues or disagreements and the proposed resolutions should be established prior to contract award.



# MOST COMMON TYPES OF INTELLECTUAL PROPERTY

Type of IP Protection	Protectable Subject Matter	Nature of Protection/Rights	Duration of Protection
<b>Patents*</b>	Processes, machines, articles of manufacture, compositions of matter, and business methods(?)	Right to exclude others from making, using, selling, or importing the invention; sometimes referred to as the right to exclude others from “practicing the invention”	20 years from application data
<b>Copyrights</b>	Original, creative works fixed in a tangible medium of expression (e.g., literary, musical or audiovisual works, computer programs)	Exclusive right to (1) copy; (2) modify; (3) perform; (4) display; and (5) distribute copies of copyrighted work. No protection against independent creation of similar works, or against certain “fair uses”	Life of author plus 70 years
<b>Trade Secrets</b>	Any information having commercial value by being kept secret (e.g., technical, business, or financial information)	Right to control the disclosure and use of the information through contracts or nondisclosure agreements, protection against theft or misappropriation of that information, but not from independent creation or discovery by another party	Potentially unlimited, as long as remains secret
<b>Trademarks and Service Marks</b>	Distinctive words, phrases, or symbols that identify the source of goods or services	Protection from confusingly similar marks, deception, and unfair competition in the marketing of goods and services.	Federal registration can be renewed every 10 years

\* Information provided for “utility” patents—the most common in DoD acquisitions



## KEY DEFINITIONS – TECHNICAL DATA

---

- DFARS 252.227-7013(a)(14): “recorded information, regardless of the form or method of the recording, of a scientific or technical nature.”
- Drawings, documented research, descriptions, designs, processes.
- In the form of texts, graphs, pictures, recorded information, and the like.
- Does not include computer software or data incidental to contract administration, such as financial or management records.





## KEY DEFINITIONS – COMPUTER SOFTWARE

---

- DFARS 252.227-7013(a)(3). Computer programs, source code, source code listings, object code listings, design details, algorithms, processes, flow charts, formulae, and related material that would enable the software to be reproduced, recreated, or recompiled.
- Does not include computer databases or computer software documentation.
- DFARS 252.227-7013(a)(4). Computer Software Documentation provides instructions, such as owner's manuals, installation instructions, and similar items, whether in print or on a CD-ROM.



# RIGHTS IN NONCOMMERCIAL COMPUTER SOFTWARE AND TECHNICAL DATA

Rights Category	Criteria for Applying Rights Category	Permitted Uses w/in Government	Permitted Uses outside Government
<b>Unlimited Rights</b>	Development exclusively at Government expense; also any deliverable of certain types—regardless of funding (e.g., FFFIOMT)	Unlimited; no restrictions	
<b>Government Purpose Rights</b>	Development with mixed funding	Unlimited; no restrictions	Only for “Gov’t purpose”; no commercial use
<b>Limited Rights (applies to TD only)</b>	Development exclusively at private expense	Unlimited; except may not be used for manufacture	Emergency repair/overhaul; evaluation by foreign government
<b>Restricted Rights (applies to CS only)</b>	Development exclusively at private expense	Only one computer at a time; minimum backup copies; modification	Emergency repair/overhaul; certain service and maintenance contracts
<b>Prior Government Rights</b>	Whenever Government has previously acquired rights in the deliverable TD/CS	Same as under the previous contract	
<b>Specifically Negotiated License Rights</b>	Mutual agreement of the parties when standard rights categories do not meet parties’ needs	As negotiated by the parties; however, must not be less than limited rights in tech data, and must not be less than restricted rights in computer software	



## CRITERIA FOR GOVERNMENT PROTECTION

---

### ➤ “DEVELOPED” – DFARS 252.227-7013

“Developed” means an item, component, or process exists and is workable.

“Developed” should not be confused with development of technical data.

“Developed” only means “that there is a high probability that it will operate as intended” rather than being at a stage ready to be offered for sale or sale in the commercial market.

There is an analogous definition of “developed” as applied to computer software in DFARS 252.227-7014.



## ***CATEGORIES OF RIGHTS TO PROTECT***

---

- The Government has **unlimited rights** in a contractor's Technical Data in the following nine (9) situations (DFARS 252.227-7013(b)(1)):
  1. Data pertaining to an item that was developed exclusively with Government funding of a contract (not funding reimbursed by the Government through indirect cost pools).
  2. Data produced under a contract that was created as part of the performance under the contract.
  3. Data created exclusively with Government funding in the performance of a contract, even if the item to which the data pertains is not produced or developed under the contract.



## ***CATEGORIES OF RIGHTS TO PROTECT***

---

4. Form, fit and function data.
5. Data necessary for installation, operation, maintenance or training purposes.
6. Corrections or changes to data that the Government provided to the contractor.
7. Data that is publicly available or data that has been released to third parties without restrictions on use.
8. Data in which the Government has obtained unlimited rights under another contract or as a result of negotiations.
9. Data that was previously given to the Government with lesser rights and the restrictions have expired.



## ***CATEGORIES OF RIGHTS TO PROTECT***

---

- The Government has unlimited rights in a contractor's Noncommercial Computer Software or Computer Software Documentation in the following six (6) situations (DFARS 252.227-7014(b)(1):
  1. Computer Software developed exclusively at Government expense.
  2. Computer Software Documentation required to be delivered under contract.
  3. Corrections or changes to Computer Software or Documentation furnished to the contractor by the Government.
  4. Computer Software or Documentation is publicly available.
  5. Computer Software that the Government obtained with unlimited rights under another contract or as a result of negotiations.
  6. Computer Software that was previously given to the Government with lesser rights and the restrictions have expired.





## ***CAUTION: FLOWDOWN CLAUSES FOR DATA RIGHTS***

---

If you as the prime contractor are obligated to provide the Government with a deliverable to use data rights of your subcontractor,

Make sure your subcontractor is obligated to provide the Government and you with access to data rights, and

Make sure that the appropriate flowdown clauses are included in the contract with your subcontractor.

Otherwise, as the prime, you could be obligated to provide more data rights to the Government than you will be able to deliver.



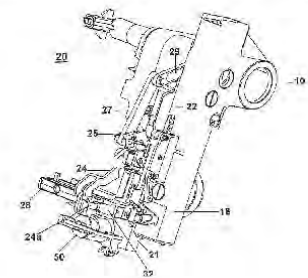
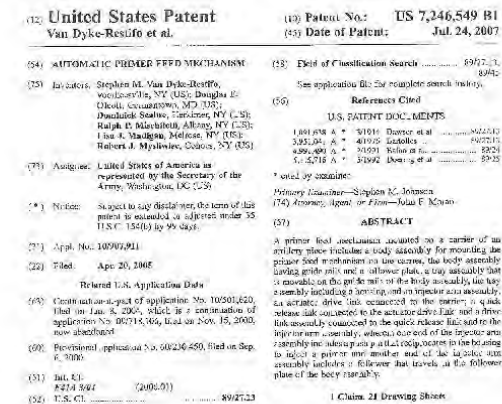


# PATENT AND INVENTION RIGHTS

## FAR Part 27 prescribes policies, procedures, and contract clauses pertaining to patents

### Current Department of Defense Framework

- ☐ Contractors are generally permitted to retain ownership (i.e., title) of inventions first “made” during the performance of a government contract. The Government receives a nonexclusive license to use that invention for Government purposes. The granting of a license to the Government is not negotiable under a FAR contract, grant or cooperative agreement.
- ☐ A “background invention” is any invention—other than an invention made during performance of a government contract (Subject Inventions) – that is owned or licensed by the contractor, and that will be incorporated into contract deliverables; the contractor must take affirmative steps to identify background inventions and any restrictions on the Government’s use



## ***PATENT AND INVENTION RIGHTS (cont'd)***

---

### **FAR 52.227-11 Patent Rights—Ownership by the Contractor (Dec 2007) Or DFARS 252.227-7038 (Large Business)**

- ☐ Contractor must disclose inventions within two months after the inventor discloses in writing to contractor personnel.
- ☐ Contractor will flow down the same rights to the subcontractor and will not, as part of the consideration for awarding the subcontract, obtain rights in the subcontractor's subject inventions
- ☐ Contractor will only grant exclusive rights in subject inventions in the U.S. to those manufacturing substantially in the U.S.
- ☐ Government has "march in rights" if contractor does not commercialize within reasonable time



## ASSERTING RESTRICTIONS ON TECHNICAL DATA

**Reference DFARS 252.227-7013(e) Identification and delivery of data to be furnished with restrictions on use, release or disclosure**

Example (hypothetical guided munition):



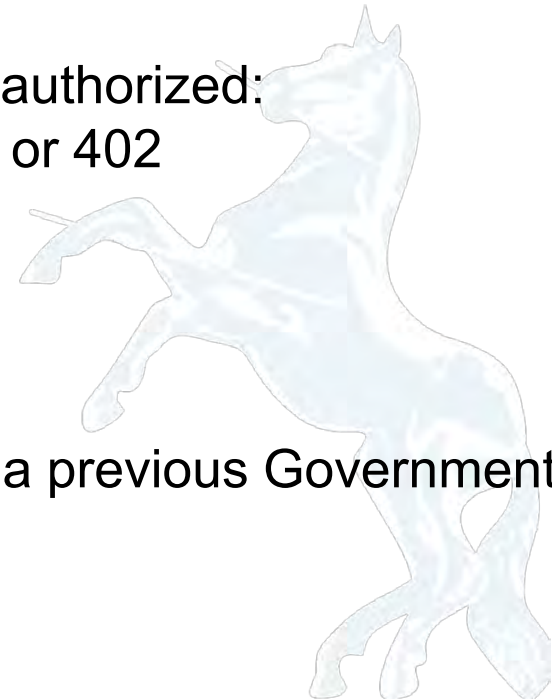
Technical Data to be Furnished With Restrictions	Basis for Assertion	Asserted Rights Category	Name of Person Asserting Restrictions
Fuze S&A	Developed exclusively at contractor expense	Limited	XYZ Inc.
GPS Receiver	Developed exclusively at contractor expense	Limited	ABC Inc. (subcontractor)
Navigation algorithms	Developed exclusively at contractor expense	Restricted	XYZ Inc.



# ***RESTRICTIVE MARKINGS ON NONCOMMERCIAL DATA AND SOFTWARE***

---

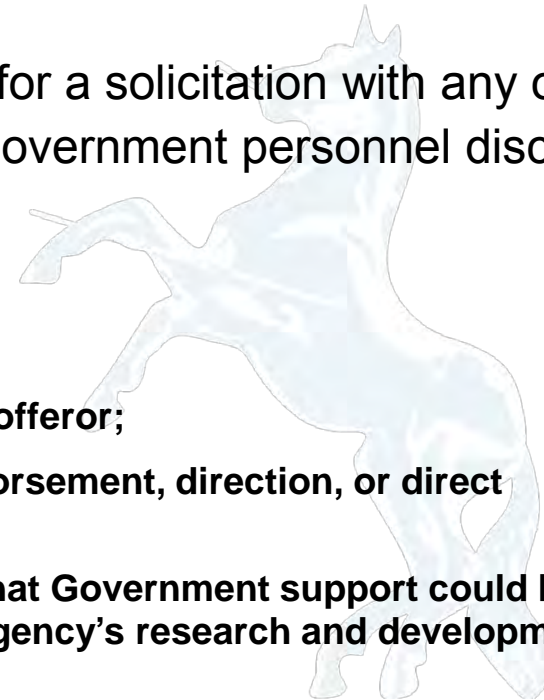
- ❑ Restrictive Markings are required for all noncommercial technical data and computer software being delivered with less than unlimited rights.
- ❑ See DFARS 252.227-7013 for specific procedures for placement of restrictive markings.
- ❑ There are only six types of legends that are authorized:
  - A notice of copyright under 17 USC 401 or 402
  - Government purpose rights legend
  - Limited rights legend
  - Restricted rights legend
  - Special license rights legend
  - Pre-existing markings authorized under a previous Government contract



## ***FAR SUBPART 15.6 “UNSOLICITED PROPOSALS”***

---

- ❑ Unsolicited proposals (UP) are a valuable means for Government Agencies to obtain innovative new ideas outside of response to publicized solicitations
- ❑ UP's are offered with the intent that the Government will enter into a contract with the offeror
- ❑ The Government may not use UP's as the basis for a solicitation with any other firms; Criminal penalties under 18 USC 1905 if Government personnel disclose restrictively marked UP information
- ❑ A valid UP must—
  - (1) Be innovative and unique;
  - (2) Be independently originated and developed by the offeror;
  - (3) Be prepared without Government supervision, endorsement, direction, or direct Government involvement;
  - (4) Include sufficient detail to permit a determination that Government support could be worthwhile and the proposed work could benefit the agency's research and development or other mission responsibilities;
  - (5) Not be an advance proposal for a known agency requirement that can be acquired by competitive methods; and
  - (6) Not address a previously published agency requirement.





# **COLT RECOMMENDED NONDISCLOSURE AGREEMENT PROVISIONS**

## **SAMPLE PROVISION FOR RECORDS RETURN OR DESTRUCTION**

*"Upon either termination or request of COLT, [COMPANY] shall promptly return or destroy all originals, recorded and unrecorded copies of Proprietary and/or Confidential Information, information derived there from and portions thereof, that remain in the possession of [COMPANY] (including Proprietary and/or Confidential Information stored on tapes, computer discs, compact discs and other media). The chief executive officer of [COMPANY] shall certify in writing its return or destruction of the Proprietary and/or Confidential Information to COLT."*



# ***COLT RECOMMENDED NONDISCLOSURE AGREEMENT PROVISIONS***

---

## **SAMPLE RECORDS RETURN OR DESTRUCTION CERTIFICATE**

The undersigned officer of \_\_\_\_\_ (the “Company”) hereby certifies as follows:

1. The Non-Disclosure Agreement (NDA), [date], between the Company and Colt Defense LLC (“Colt”) expired or was terminated in accordance with its terms, and the Company has a duty to destroy all Confidential Information of Colt in its possession in accordance with the terms of the NDA and to provide this certification.
2. The Company certifies that it has destroyed all Confidential Information of Colt in its possession, including but not limited to the following drawings: [describe]
3. The Company covenants and agrees that after making this Certification, if it discovers that there is still Confidential Information of Colt in its possession, it shall promptly destroy such Confidential Information and notify Colt in writing of such fact, to be addressed to [Colt contact].
4. The Company acknowledges that aforesaid Confidential Information of Colt in its possession has been destroyed as of [date].

IN WITNESS WHEREOF, I have affixed my signature as officer of the Company and have caused the seal of the Company to be affixed hereunto, as of this \_\_\_\_ day of \_\_\_\_\_ 20\_\_.

\_\_\_\_\_  
[Name, Title, Date]





# NON-FAR AGREEMENTS

---

MANY TYPES (partial list)

- ☐ Cooperative Agreements
- ✓ Cooperative Research and Development Agreements
- ☐ Educational Partnership Agreements
- ☐ Grants
- ☐ MOUs/MOAs
- ✓ Other Transaction Agreements
- ✓ Patent License Agreements
- ✓ Sale of Testing
- ✓ Will discuss in more detail



## WHAT IS A CRADA?

---

- ❑ Cooperative Research and Development Agreement (CRADA) authority is in 15 U.S.C. 3710(a)
- ❑ A CRADA is not a FAR contract (very flexible and broad authority)
- ❑ An agreement between a Federal Laboratory and one or more non-Federal parties under which the Government, through its laboratories, provides personnel, services, facilities, equipment, Intellectual Property or other resources, with or without reimbursements; Non-Federal parties can provide all of the above, including funds
- ❑ Specific R&D efforts which are consistent with the missions of the Laboratory
- ❑ FOIA Protection for 5 years
- ❑ Intellectual Property Rights defined
  - Collaborating Party has option for exclusive license for pre-negotiated field of use to CRADA Subject Inventions (subject to Government normally retaining certain government purpose rights)
  - Can license Government background inventions
  - Data rights negotiable



## WHAT IS an Other Transaction?

---

- ❑ “OT” commonly refers to 10 U.S.C. 2371 authority to enter into transactions other than contracts, grants or cooperative agreements; i.e., an OT is defined by what it is not!
- ❑ Prototype Other Transaction: “Commonly referred to as “845” Agreements after section 845 of the NDAA originally authorizing such agreements (Most common type used by Picatinny, and the type of OT discussed here)
- ❑ 845 OT’s are directly related to prototyping of weapons or weapon systems, defined broadly to include sub-systems, components, technology demonstrations
- ❑ “Non-traditional” participation or “Traditional” cost share required
- ❑ Purpose: (1) flexibility in contract requirements (e.g., intellectual property, cost accounting) to attract technology firms who do not supply DoD (i.e., non-traditional); (2) flexibility to structure novel agreements with traditional industry, on a case-by-case basis, when FAR contracts, CAs, and grants don’t satisfy the requirement



## ***WHAT Is a Patent License Agreement?***

---

- ❑ Authority: 35 U.S.C. 202(e), 35 USC 207(a)3, and 15 U.S.C. 3710
- ❑ Terms, conditions and procedures further prescribed in 37 CFR 404
- ❑ It is the policy and objective of Congress to use the patent system to promote the utilization of inventions arising from federally supported research and development
- ❑ Licensing Government-owned inventions:
  - Applicant must supply satisfactory plan for developing or marketing of the invention-- except CRADA Subject inventions (see 15 U.S.C. 3710); Licensee must carry out the plan within reasonable time
  - Government may collect royalties, which are shared with Government inventors as an incentive for innovation
  - Government normally retains government purpose rights
  - Substantial U.S. manufacture normally required
  - Licensee may extend to subsidiaries if provided in the license; assignment subject to Government approval
  - March in rights; Small business preference



## WHAT IS A TEST SERVICE AGREEMENT?



*Davidson Advanced Warhead  
Development Facility*



*Armament Software Engineering Center*

- ❑ Authority: Picatinny's authority is 10 USC 2539b(a)(3)
- ❑ May sell services for testing of materials, equipment and computer software and other items
- ❑ Full cost reimbursement required
- ❑ **Confidentiality of Test Results**--The results of tests are confidential and may not be disclosed outside the Federal Government without the consent of the persons for whom the tests are performed



## ***HOW IT ALL FITS TOGETHER—Some recent cases***

---

- ❑ M4 Carbine
- ❑ Munitions Assembly Conveyor





## COLT M4 CARBINE

---

- ❑ Army awarded Contract No. DAAF03-67-C-0108 to Colt to make the M16 Rifle
- ❑ Army procured the M16 Rifle for military use by US Armed Forces beginning in the Vietnam War
- ❑ In the late 1980's Colt developed the precursor of the M4 Carbine exclusively with private funds
- ❑ In 1988, Colt lost the M16 contract to FN Manufacturing
- ❑ In 1990, the M16 License became fully paid up
- ❑ The same year, Army conducted an initial product test (IPT) and type classified it as the M4, which had 80% parts commonality with the M16
- ❑ Army took the position that the M4 was a derivative of the M16 or that Army had acquired data rights to the M4
- ❑ In 1997, at Army Materiel Command, Colt proved that the critical and unique parts of the M4 were not related to the M16 and that their development was not funded by the Government
- ❑ The Government recognized Colt's rights to the M4 TDP and agreed to purchase all of its M4 requirements from Colt





## **\*SPECTRUM SCIENCES V. UNITED STATES**

---

- ☐ Munitions Assembly Conveyor (MAC) is part of Air Force (USAF) bomb assembly operation
- ☐ MAC was originally developed in 1970's
- ☐ In 2000, Spectrum Sciences self-funded MAC improvements and subsequently entered into a CRADA with USAF
- ☐ Key CRADA provisions
  - Proprietary information defined; shall not be disclosed except under confidentiality agreement with employees and contractors of receiving party who have a need for the information in connection with [the CRADA]
  - CRADA describes Spectrum technology to be protected
- ☐ USAF uses CRADA-related information while preparing a RFP without Spectrum notification, review or comment
- ☐ Spectrum asserts RFP contained their Proprietary information
- ☐ Spectrum didn't win
- ☐ Spectrum sued and Court of Claims ruled in Spectrum's favor

\*Source: Holland & Knight Intellectual Property Group presentation to NDIA Small Business Breakfast, Jan 15, 2009, "Improving IP Protection"  
[http://www.ndia.org/Divisions/Divisions/SmallBusiness/Documents/914B/914B\\_Moran,\\_John.pdf](http://www.ndia.org/Divisions/Divisions/SmallBusiness/Documents/914B/914B_Moran,_John.pdf)



## REFERENCES

---

- ❑ “Intellectual Property: Navigating Through Commercial Waters”, USD(AT&L), October 15, 2001
- ❑ USD(AT&L) Memorandum, 19 July 2007, “Data Management and Technical Data Rights
- ❑ ASA(ALT) Memorandum, 8 Jan 2010, “Data Management, Technical Data Rights and Competition”
- ❑ Intellectual Property in Government Contracts, 6<sup>th</sup> Edition, Nash and Rawicz
- ❑ MIL-HDK-X131 (Draft), Acquisition Data Management
- ❑ Federal Technology Transfer Legislation and Policy, by Federal Laboratory Consortium for Technology Transfer
- ❑ Acquisition Central, [www.acquisition.gov](http://www.acquisition.gov)
- ❑ Federal Acquisition Regulations, [www.acquisition.gov/FAR](http://www.acquisition.gov/FAR)
- ❑ Defense Acquisition Regulations System <http://www.acq.osd.mil/dpap/dars/index.html>
- ❑ United States Code, [uscode.house.gov](http://uscode.house.gov)
- ❑ Code of Federal Regulations, [www.gpoaccess.gov/cfr](http://www.gpoaccess.gov/cfr)
- ❑ U.S. Army ARDEC Technology Transfer Website <https://www.pica.army.mil/techtran/>



## **CONTACT INFORMATION**

---

☐ **Tim Ryan**  
**US Army ARDEC**  
**973-724-7953**  
**timothy.s.ryan@us.army.mil**

☐ **Carlton Chen**  
**Colt Defense LLC**  
**860-244-1315**  
**cchen@colt.com**



## CONCLUDING REMARKS

- ☐ We hope we demystified at least some issues involving IP and data rights.
- ☐ The acquisition strategies of DoD and Industry interests often intersect over IP and data rights.
- ☐ Early planning to identify and resolve IP and data rights issues is essential.
- ☐ Be mindful of the specialized IP and data rights issues that are available for use in doing business with the Government.
- ☐ Recognize that provisions involving IP and data rights are frequently negotiable.
- ☐ The Government is willing to be flexible and creative to protect its interests as well as the contracting party.
- ☐ Seek competent legal advice; IP is very complex.



# ***Improving the Accuracy of Precision Guided Munitions with a GPS Ephemeris & Ionospheric Correction Sharing Service (GEISS)***

Joint Armaments Conference 2010  
May 18, 2010

**Charles Johnson**

NAVSYS Corporation  
Colorado Springs, CO  
(719) 481-4877 [www.navsys.com](http://www.navsys.com)

# ***What is the Problem?***

- Small precision guided munitions need high accuracy GPS for guidance
- Munitions must be initialized prior to launch to allow rapid GPS acquisition
- GPS guided weapons only use satellites for navigation with pre-loaded NAV data
- Denial of GPS service at launch platform also limits PGM navigation performance



# ***What is the Solution?***

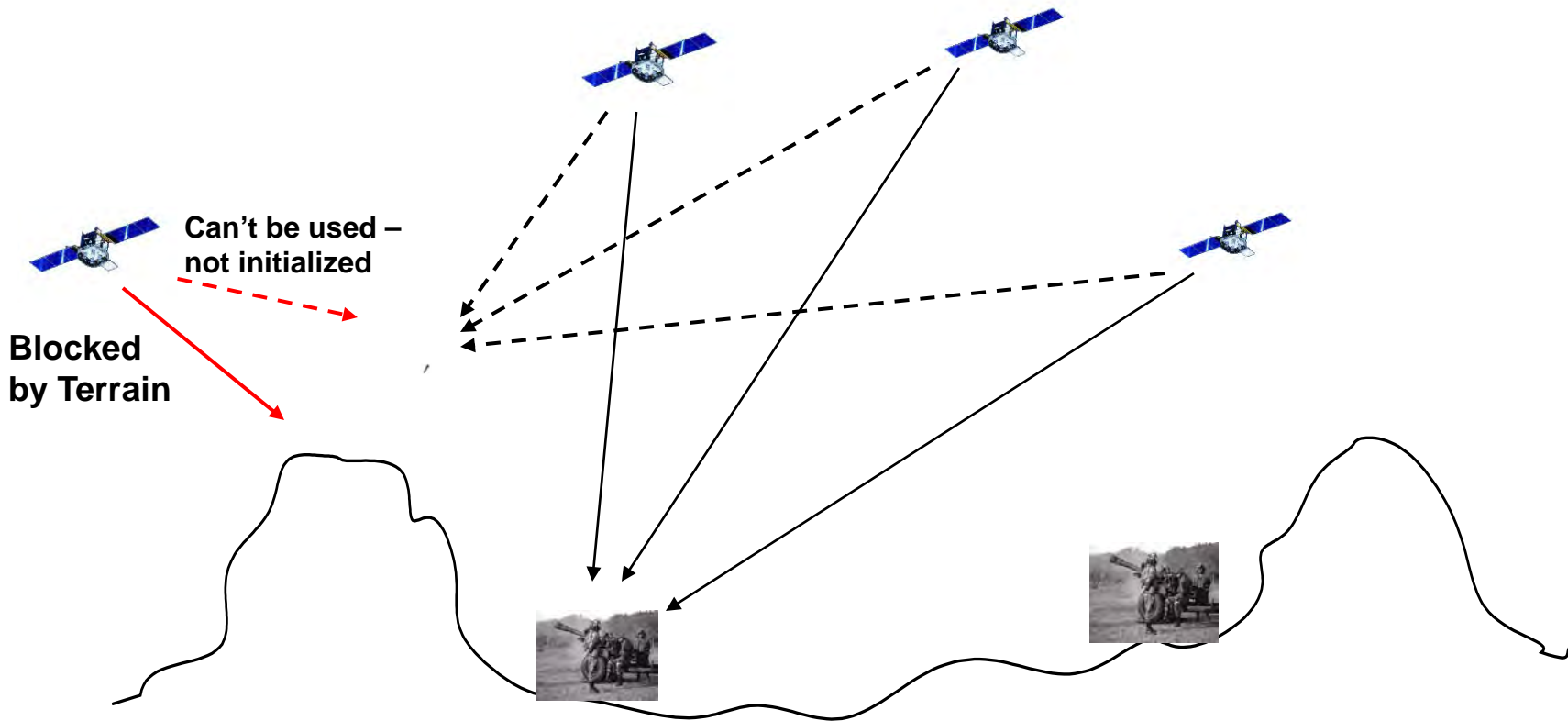
- GPS Ephemeris and Ionospheric Sharing Service (GEISS)
  - Shares ephemeris data and ionospheric corrections across AFATDS network
  - PGMs are initialized with data from all satellites in view across the network
  - Allows PGMs to operate with more GPS satellites once they have a better sky view following weapons launch



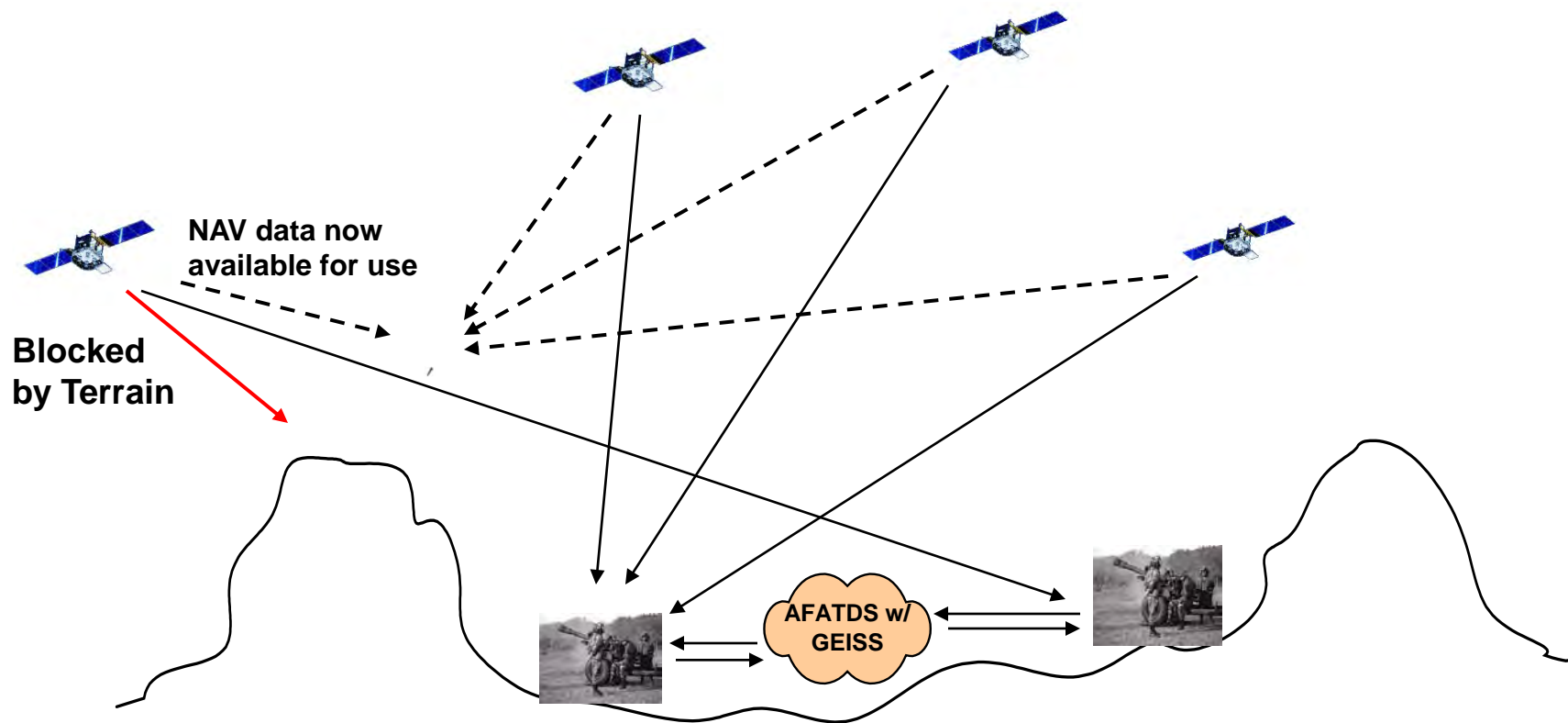
# ***GPS-Guided Munitions that Could Benefit from GEISS***

- Munitions
  - Excalibur
  - M107, M549/A1, M795 (w/ PGK)
- Platforms
  - Paladin, M777A2, Digitized M119

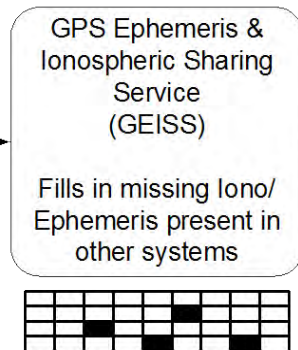
- Currently, munitions are initialized with navigation, ephemeris, and lono data from each weapon platform (WP) GPS receiver, using only satellites visible to that platform
- In flight, navigation data is only used from “initialized” satellites, reducing accuracy



- GEISS “combines” satellite information from each WP GPS receiver and supplies the complete set to each WP through AFATDS for munitions initialization
- This allows even initially blocked satellites to be used in flight when available



Option to sync with  
PGE data when  
SIPRNET connected

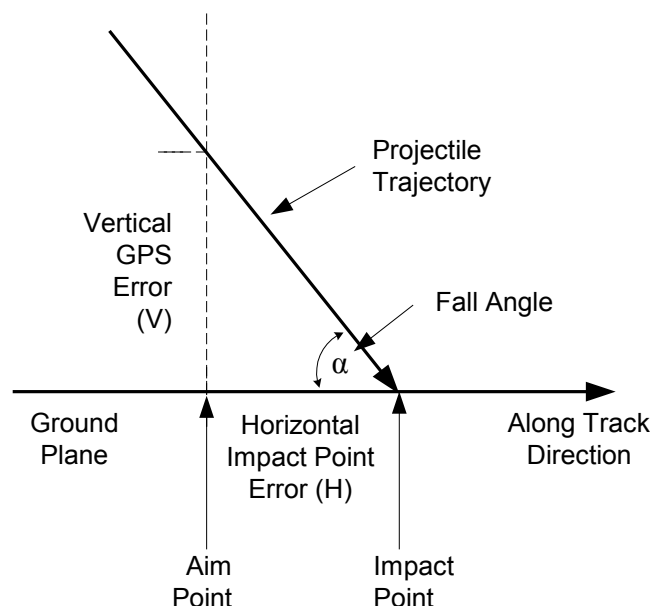


**AFATDS**



Note: TCM-Cannon personnel will make final determination on all GEISS, AFATDS, and Weapon Platform requirements

# Aim Point Errors

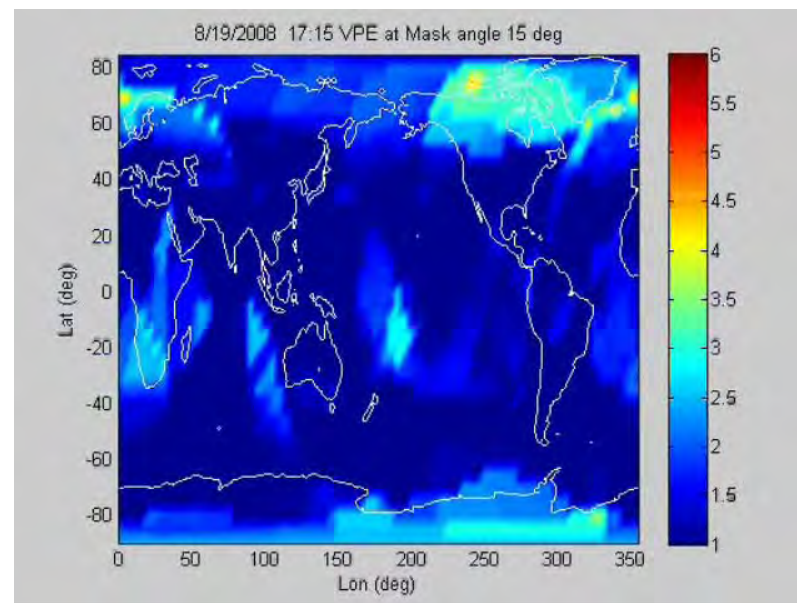
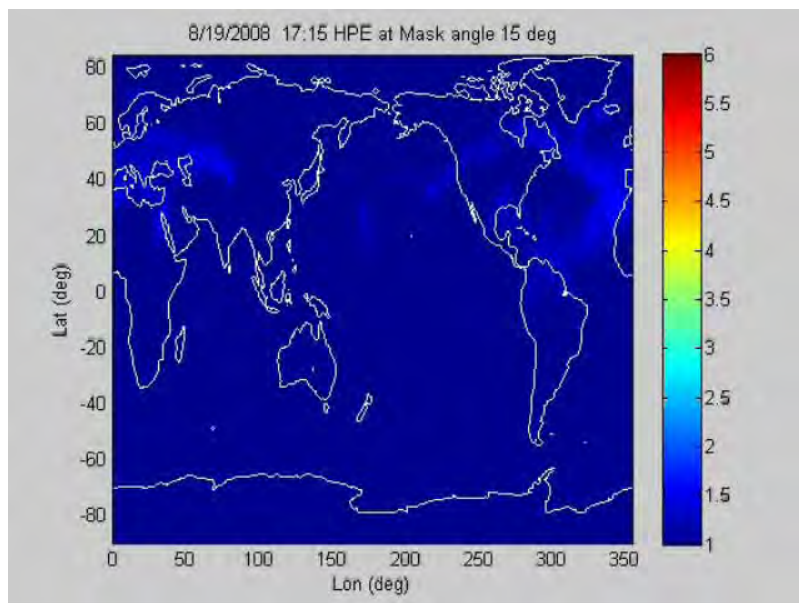


- Horizontal GPS bias errors map into horizontal aim point errors (earth referenced frame)
- Vertical GPS bias errors map into horizontal aim point errors through munition fall angle
  - Result in along track errors

Vertical GPS errors map into along track aim point errors

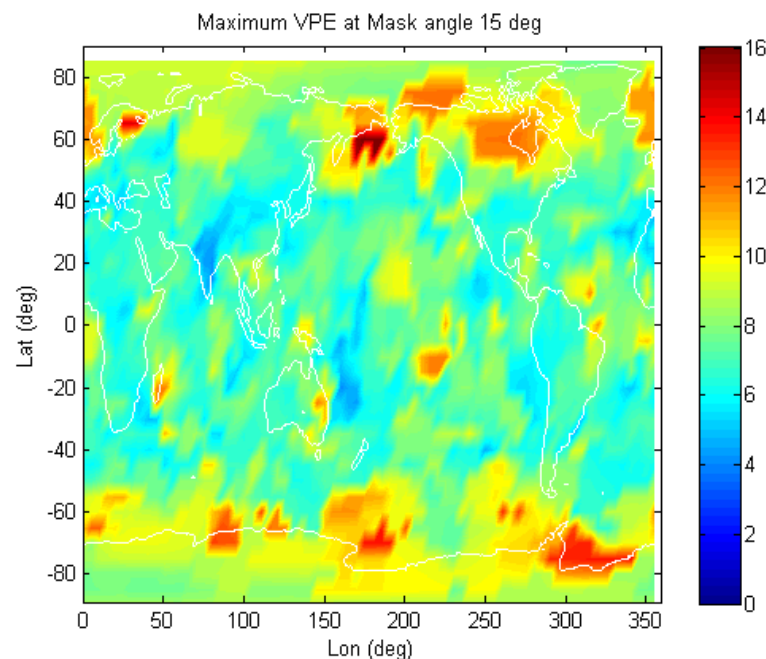
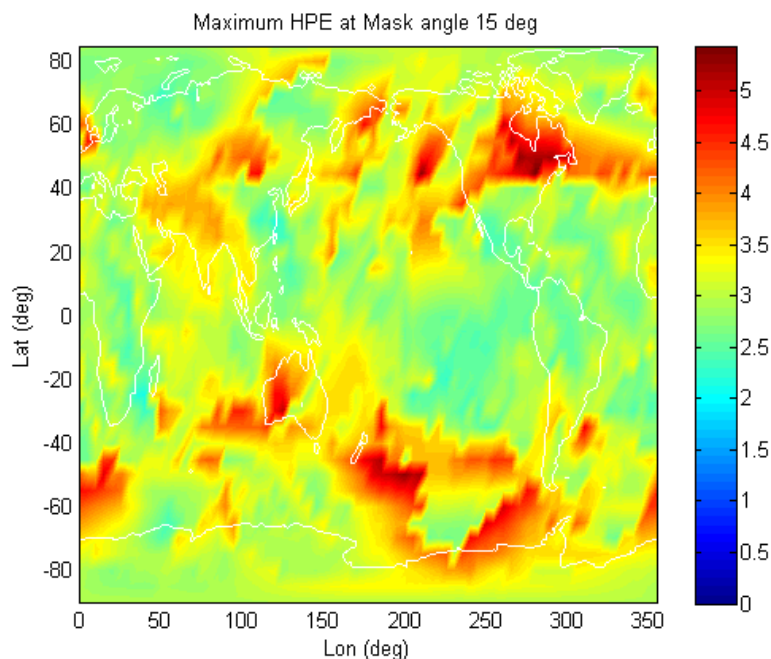
# ***HPE and VPE***

## ***Antenna 15 Degree Mask Angle***





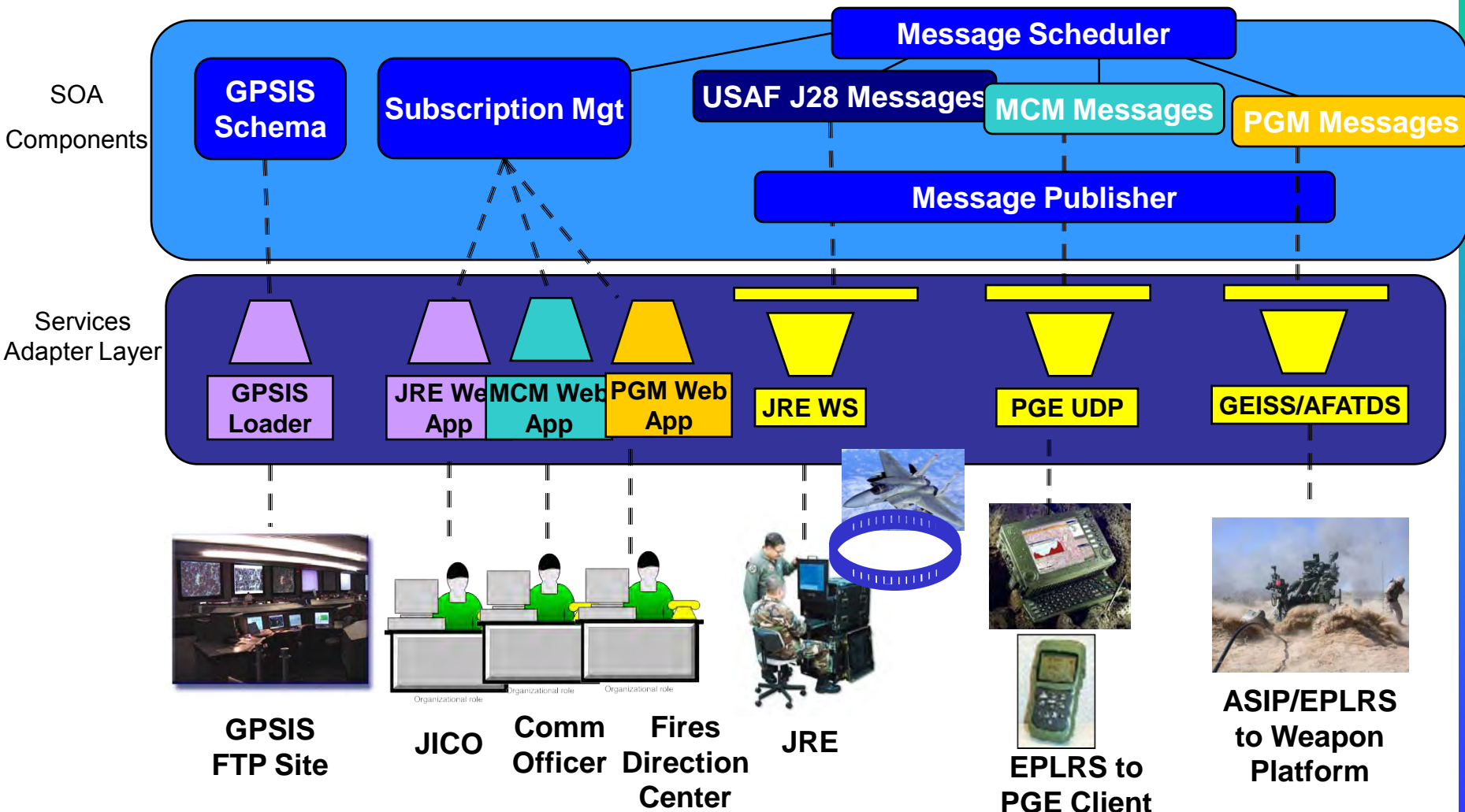
# ***Maximum HPE and VPE Antenna 15 Degree Mask Angle***



Note: Different meter error scale on side for HPE vs VPE



# GEISS/PGE Integration Option

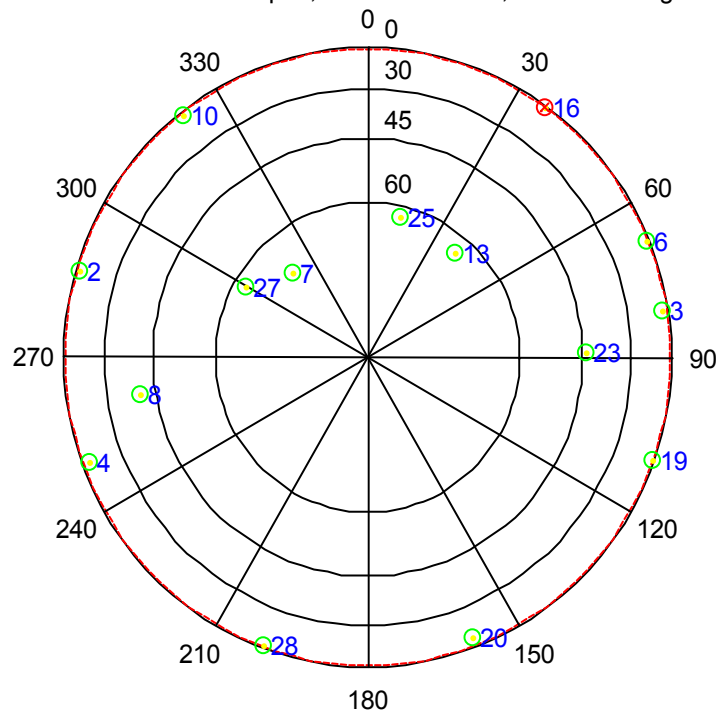


# Scenarios

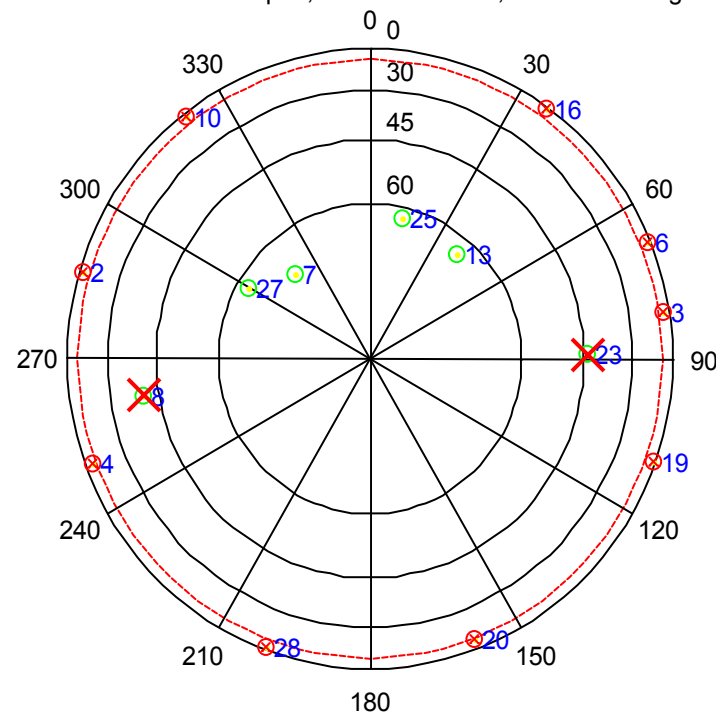
1. Open Sky (mask angle 5 deg, DAGR default)  
Baghdad 0500Z, 9 Sep 08  
HDOP = 0.71 VDOP= 0.84
2. Far Field Terrain (mask angle 15 deg)  
Baghdad 0500Z, 9 Sep 08  
HDOP = 5.64 VDOP= 9.61 VAPP
3. Hide Site (mask angle 40 deg) FOM > 1  
Baghdad 0500Z, 9 Sep 08  
HDOP = 0.71 VDOP= 0.84

# Scenarios

Azimuth Elevation plot, view from above, mask = 5 deg



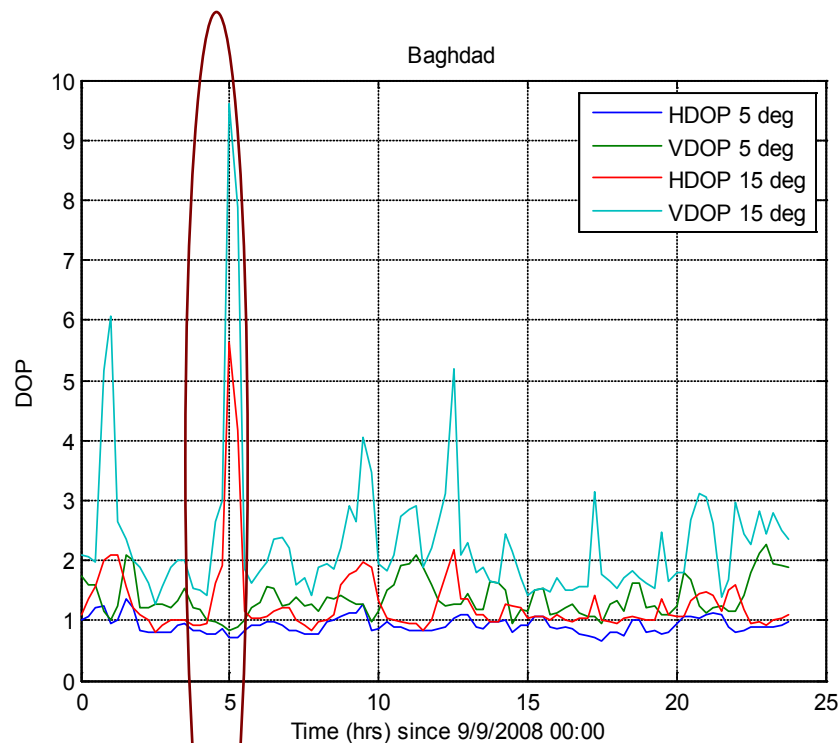
Azimuth Elevation plot, view from above, mask = 15 deg



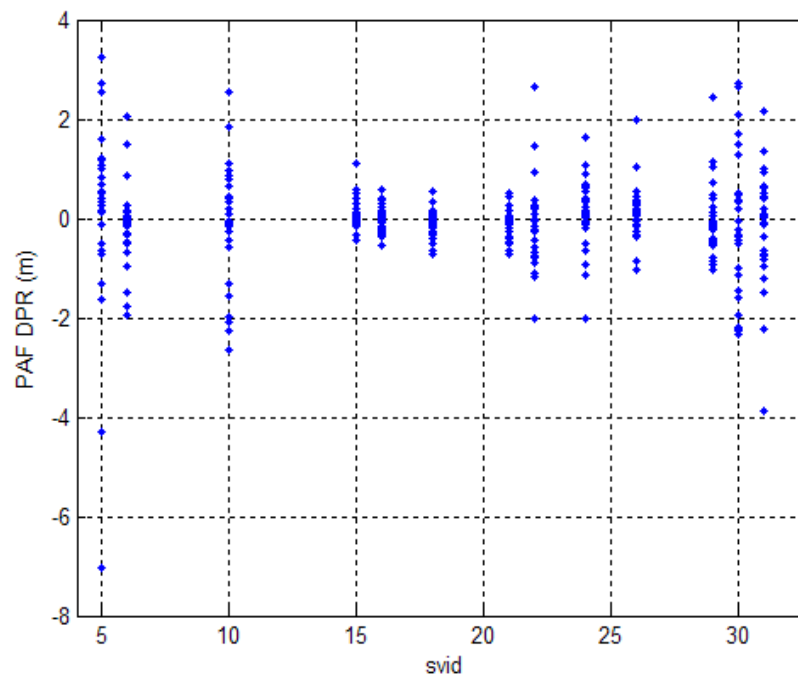
	Mask (degree)				
DOPs	0	5	10	15	20
HDOP	0.65	0.71	1.39	5.64	5.64
VDOP	0.79	0.84	1.72	9.61	9.61
GDOP	1.11	1.20	2.48	13.11	13.11

At mask angles >40 deg,  
FOM exceeds 1, resulting  
in no shot

# Baghdad Performance Analysis

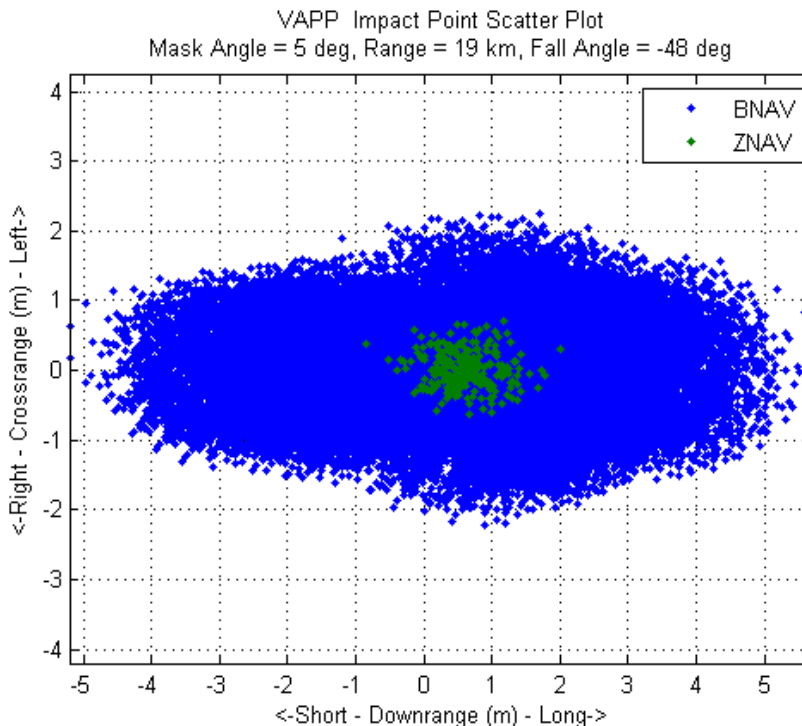
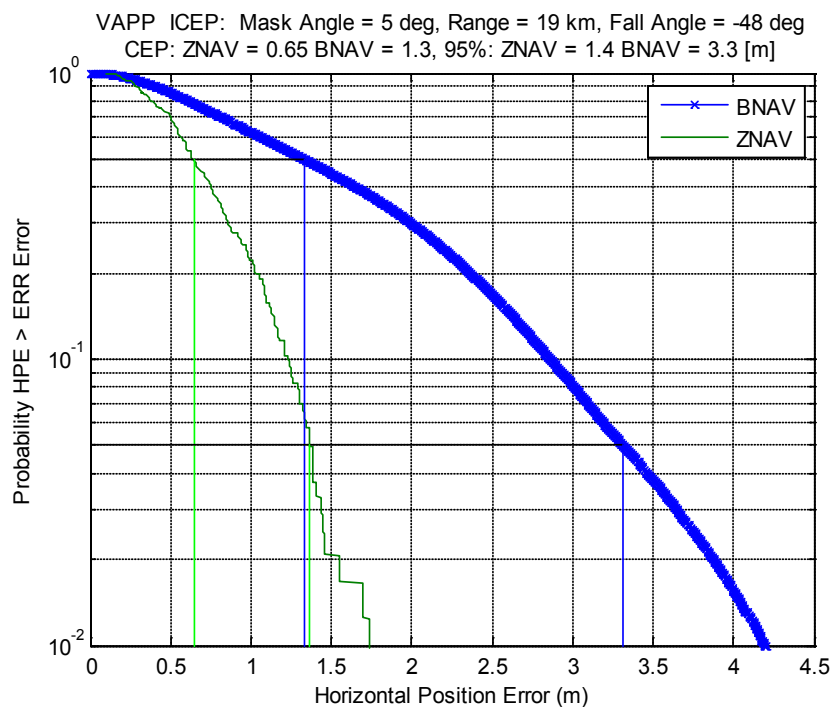


Time selected



30 Day PAF errors for SVs in view  
at selected sidereal time

## 1. Local DAGR Open Sky ICEP & X/Y Plot 5 deg Mask, Baghdad (HDOP=0.71 VDOP=0.84) Range: 19 km, Fall Angle: 48 deg

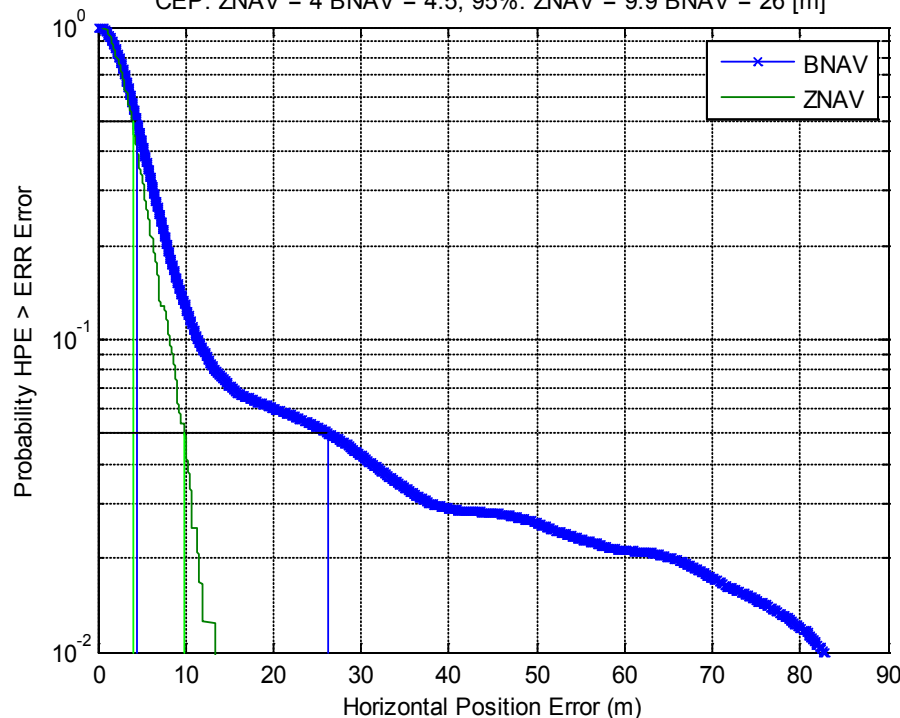


**ZNAV CEP = 0.65m**  
**BNAV CEP = 1.30m**

**ZNAV 95% = 1.4m**  
**BNAV 95% = 3.3m**

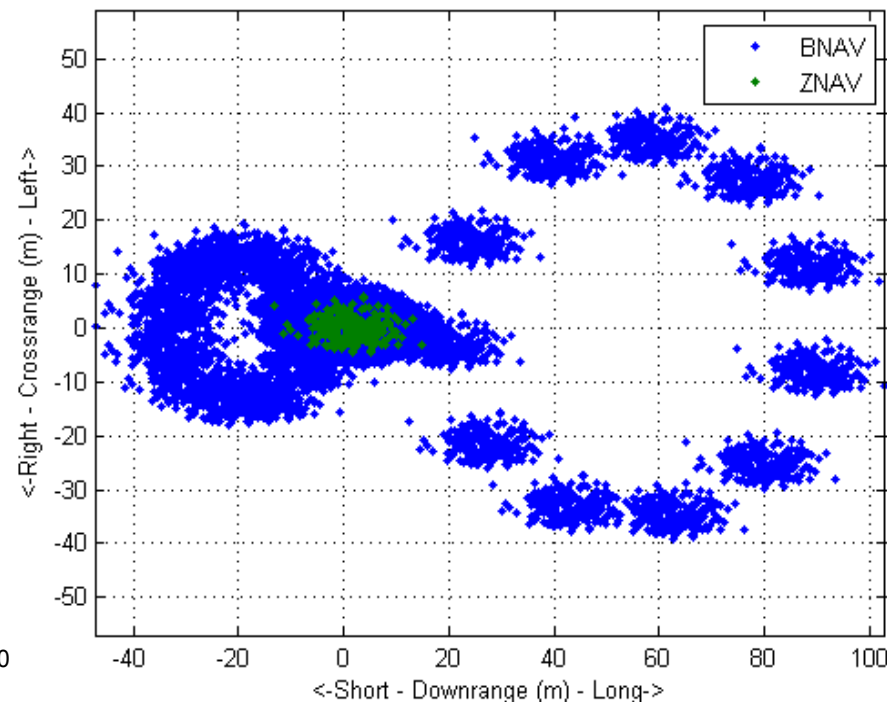
## 2. Local DAGR Open Sky ICEP & X/Y Plot 15 deg Mask, Baghdad (HDOP=5.6 VDOP=9.6) Range: 19 km, Fall Angle: 48 deg

VAPP ICEP: Mask Angle = 15 deg, Range = 19 km, Fall Angle = -49 deg  
CEP: ZNAV = 4 BNAV = 4.5, 95%: ZNAV = 9.9 BNAV = 26 [m]



**ZNAV CEP = 4.0 m**  
**BNAV CEP = 4.5 m**

VAPP Impact Point Scatter Plot  
Mask Angle = 15 deg, Range = 19 km, Fall Angle = -49 deg



**ZNAV 95% = 9.9 m**  
**BNAV 95% = 26 m**

### ***3. Mask Angle >40 Deg***

- Without GEISS augmentation, FOM >1, no shot
- With GEISS aiding, effective mask angle reduced, allowing precision shot



# ***GEISS Scenarios Summary***

Scenario Mask angle	1. Open-Sky 5 deg	2. Far Field Terrain 15 deg	3. Hide Site 40 deg
Local DAGR	OK	Degraded	FOM > 1 No shot
PGE	High Precision	Degraded	FOM > 1 No shot
Iono & Ephemeris N/W Sharing	OK	OK	OK
PGE + Iono Sharing	High Precision	High Precision	High Precision

# ***Conclusion***

- GEISS network sharing can enhance number of satellites available for use by GPS-guided projectiles
- USA CECOM sponsoring GEISS research and demos for current and future platforms
- CERDEC/ARDEC providing technical oversight and guidance
- Integration with AFATDS will allow deployment to follow-on Excalibur and PGK projectiles with SW upgrades only

**Innovation ... Delivered.**

**Mortar Guidance Kit (MGK)**  
**2010 Joint Armaments Conference**  
**17-20 May 2010**

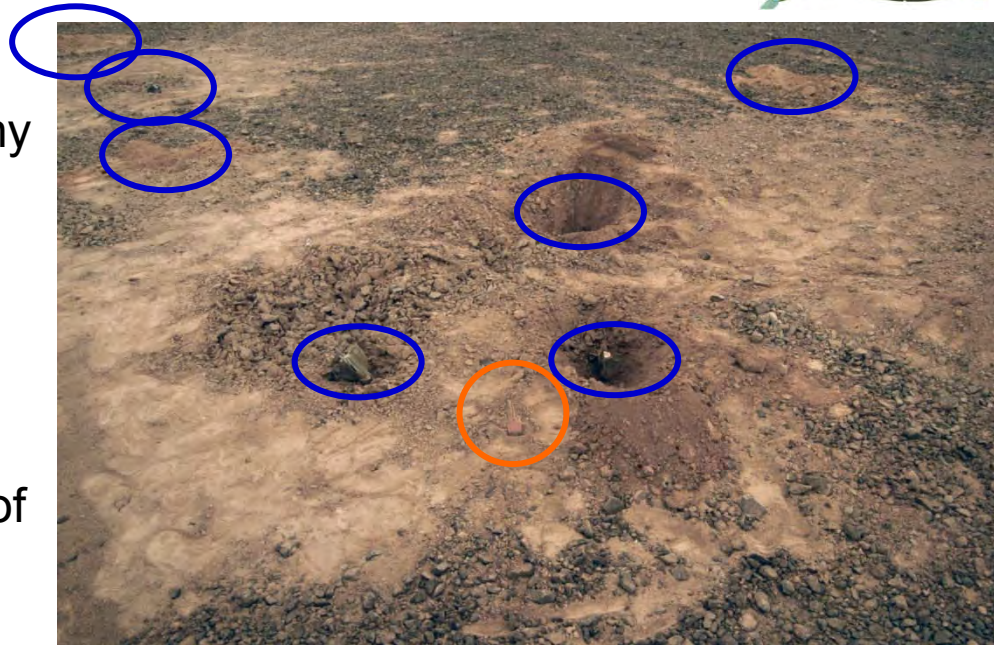
**Kelly Hanink**  
**APMI Program Manager**





## Discussion Topics

- Responding to Soldiers Needs – Why Accelerated Precision Mortar Initiative (APMI)?
- Mortar Guidance Kit (MGK) – ATK's Answer to APMI
- Demonstrated Capability – Results of Demonstration Test
- Delivering Precision – APMI Program Plan



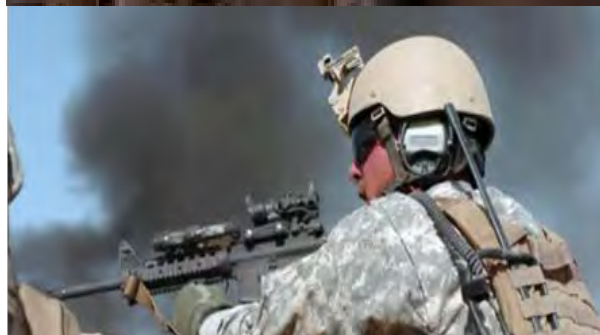
# Innovation ... Delivered



# Why APMI? – Respond to Soldier Needs



A premier aerospace and defense company



**Precision  
Benefits**



**Minimize Collateral Damage**

Approved for Public Release, PAO 563-10, dated 11 May 2010, 22 CFR 125.4(b)(13) applicable





# APMI Requirements – The needs of the Soldier



A premier aerospace and defense company



## Capabilities:

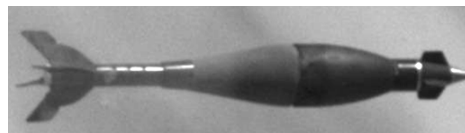
- Accuracy: 10m CEP (Threshold); 5m (Objective)
- Lethality: Similar kinetic effects of current munitions
- Maximum Range: 6.5km or greater
- Guidance: GPS Selective Availability Anti-Spoofing Module (SAASM)
- Compatibility: US 120mm Mortar System



# What is APMI? – Precision for 120mm Mortars



A premier aerospace and defense company



*XM395, 120mm HE Guided Cartridge*

***Urgent Material Release (UMR)  
of Four Systems***



***M32***

***Lightweight Handheld  
Mortar Ballistic Computer***



***Precision Lightweight Universal  
Mortar Setter System  
(XM701 PLUMSS)***

***Mortar Fire Control System***



***Stowage Kit: 120mm Mortar, M326***



***M150/M151  
Dismounted***



***120mm Mortar, M120***





# MGK – Extending PGK Innovation



A premier aerospace and defense company



Can PGK be adapted to guide a 120mm fin-stabilized mortar cannon fired projectile?

PGK is designed to guide a 155mm spin-stabilized howitzer fired projectile.



Operational Range: 6-27 km

Spin Rates: 150-275 Hz

Speeds: 330-830 m/sec

(Supersonic)

Setback ~ 20 KG

Operational Range: 1.0-6.5 km

Induced Spin Rates: 5-40 Hz

Speeds: 130-330 m/sec

(Subsonic)

Setback ~ 8.5 KG



# APMI – Integrating Demonstrated Technologies



A premier aerospace and defense company



Tail Subsystem



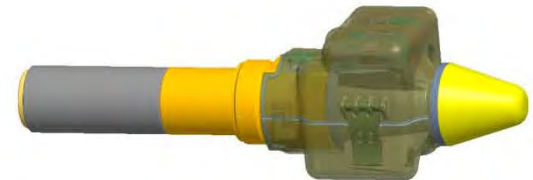
- Lengthened boom/boattail
- Standard M1020 igniter
- Proven high-hat M47 charge increments
- Proven folding fin design
  - Fin hub cant applied to induce body spin

M934 Body Subsystem



- Standard M934 mortar body
- Obturating ring for pressure seal
- Composition B explosive fill
  - Modified for deep intrusion fuze well

Nose Subsystem



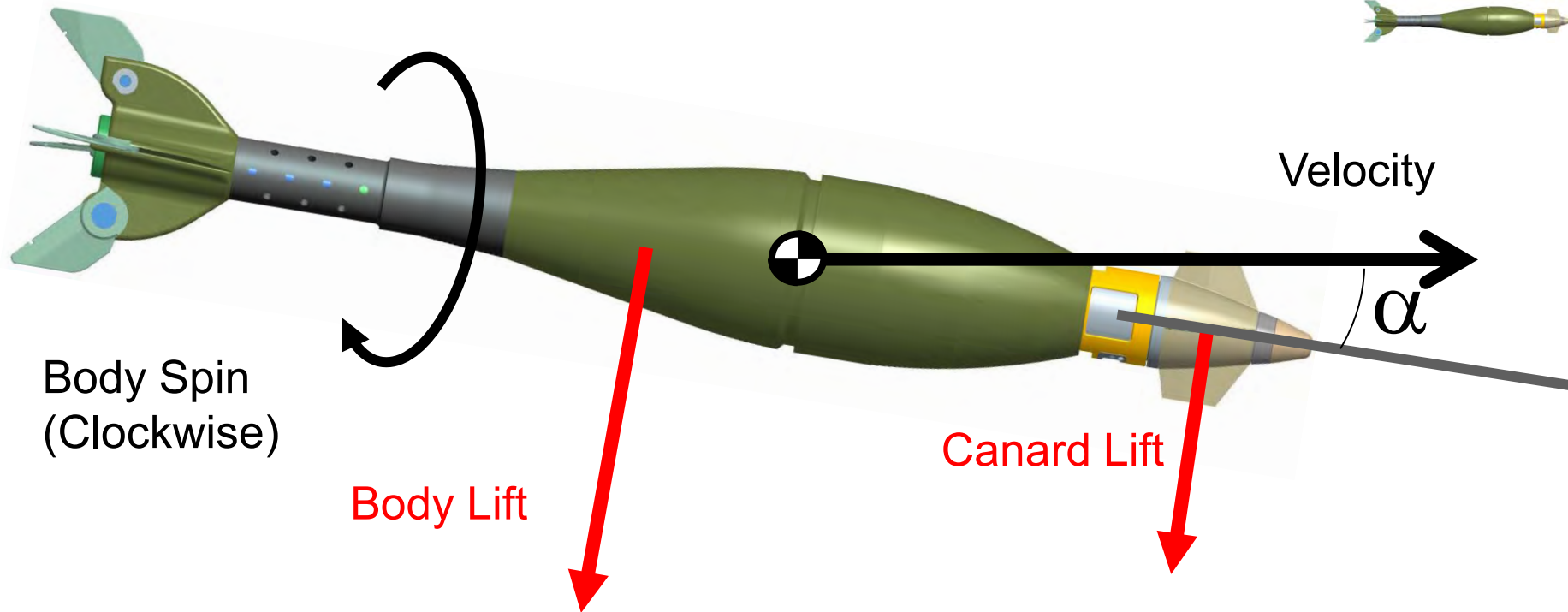
- PGK nose assembly with modifications
- Fixed canard assembly
- IEC GPS receiver
- Common Mortar S&A
- PGK booster assembly
- Canard cover for EPIAFS interface



# APMI – Simple & Effective Precision



A premier aerospace and defense company



- Steady-state must result in a moment balance
- Round noses down to counter canard moment with body pitching moment
- Body lift and canard lift in the same direction



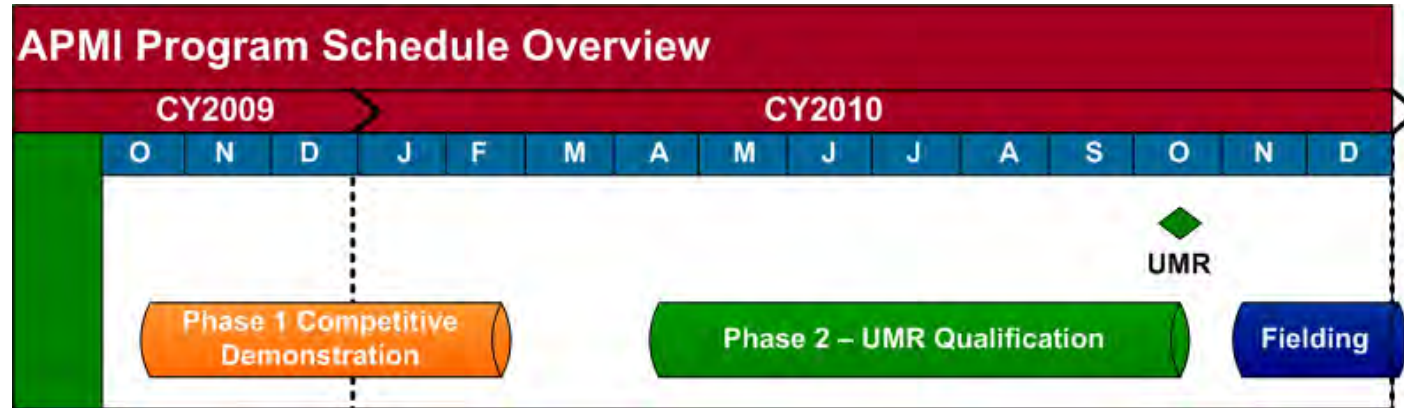
[illegible]



# APMI – Phase 2 Deliver Precision to Battlefield



A premier aerospace and defense company



**ATK selected as winner of competitive demonstration program in April 2010**

**Building hardware for qualification testing that begins Summer 2010**

**Urgent Material Release (UMR) planned for October 2010, with fielding shortly after**





## **APMI Provides Solution to Immediate Soldier Needs**

- Effective Response to the field
- ATK's MGK delivers Required Capability at completion of Competitive Phase I

## **APMI Succeeded Building on Proven Technologies**

- Type classified 120mm Mortar Systems & Fire Control
- Successful PGK program provides Basis for MGK Approach
  - MGK modifies M934 HE Cartridge making it Precise

## **ATK's MGK Demonstrated Necessary Capability**

- Delivered <10m CEP in Competitive Shoot-off

## **APMI Will Deliver Capability to the Soldier this Year**



# 45<sup>th</sup> Annual NDIA Gun and Missile Systems Conference



## Precision Guidance Kit

18 May 2010

*Tom Bybee*

PGK Technical Director  
ATK Advanced Weapons



# PGK

Precision Guidance Kit  
XM1156

Approved for Public Release, PAO 614-10, dated 18 May 2010, 22 CFR 125.4(b)(13) applicable







***ATK won a competitive shoot-off and was awarded an SDD contract in May 2007***

• M549, 18 shots, 21.1m CEP

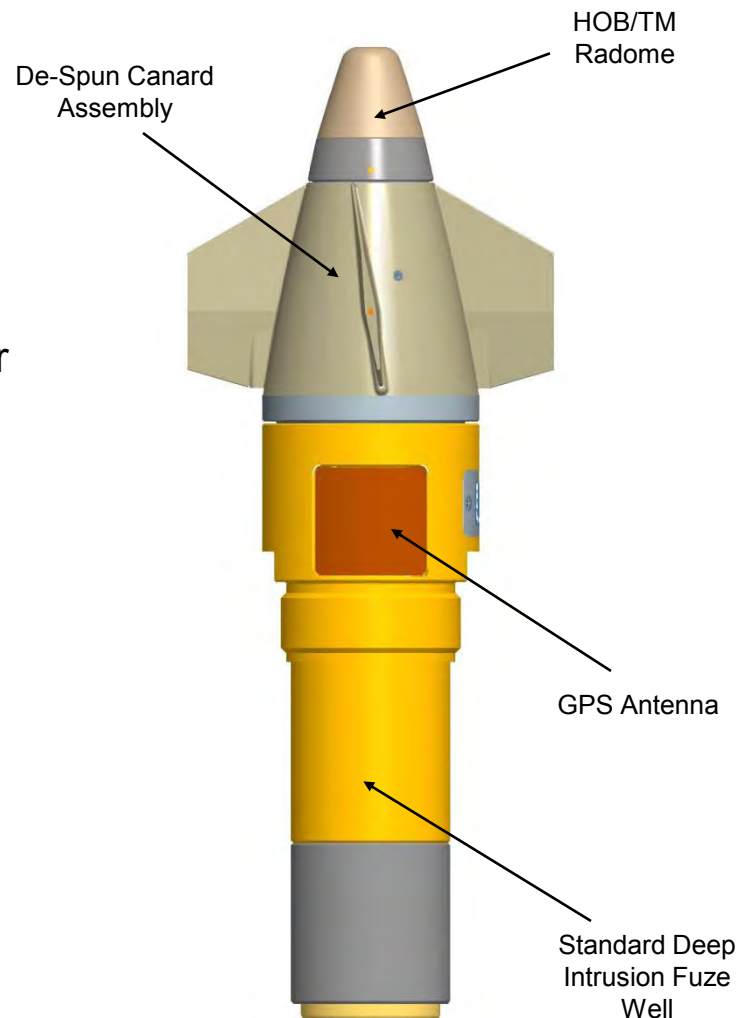
## What is PGK?

- GPS Guidance Kit with Fuzing Functions
- Replaces the existing standard 155mm artillery projectile fuze
- PGK guidance greatly improves the accuracy of conventional artillery in the inventory
  - PGK  $\ll$  50m CEP
  - Conventional  $>$  200m CEP at max range
- Maintains  $>$  90% of range capability of conventional projectile and fuze
- No Battery
- Reliable – Only one moving “part”
- Full 2D Guidance to Impact
- Point Detonation and Proximity Fuzing

**Transforms existing artillery inventory into affordable precision weapons**

## Key Innovations

- **Fixed Canards**
  - No Mechanical Actuators
- **GPS with Roll Angle Determination**
  - L3/IEC TruTrack Evolution GPS Receiver
  - No Inertial Sensors
- **No Battery**
  - Super Capacitor (pre-flight)
  - On-Board Alternator (in-flight)
- **Simple Mechanical Design**
  - No Slip Rings
- **Built-In Tactical Telemetry**
  - Development Tests
  - Stockpile Surveillance
  - Lot Acceptance Tests



PGK is designed to guide a 155mm  
spin-stabilized projectile

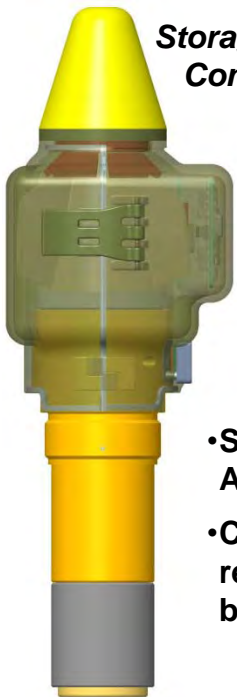
Operational Range: 6-27 km

Speeds: 330-830 m/sec

Spin Rate: 100-275 Hz

Set-back: 20 KG's

**Storage & Setting  
Configuration**



- Stored 3 per Ammo Can
- Cover is removed before firing



# Performance Requirements Summary



A premier aerospace and defense company

	Increment 1 IOC FY11	Increment 2 IOC FY15	Increment 3 IOC FY18
<b><i>Key Performance Parameters</i></b>			
<b>1. Net Ready</b>	AFATDS, EPIAFS, GPS		
<b>2. Reliability</b>	92% (T); 97% (O)		
<b>3. Accuracy</b>	≤ 50m CEP (T) ≤ 30m CEP (O)	≤ 30m CEP (T=O)	≤ 30m CEP (T) ≤ 20m CEP (O)
<b><i>Attributes</i></b>			
<b>Munition Type</b>	155mm HE • M107 • M795 • M549A1	Add: • 105mm HE (T) • 105/155mm HE & Cargo (O)	155mm HE (T) 105/155mm HE & Cargo (O)
<b>Platform Types</b>	• M777A2 • Paladin	Add M119A3 (105mm) (T)	Add Future Cannon (T)
<b>Fuzing Function</b>	• PD • Proximity	Add • Delay & Time (O)	





# Firing Platforms, Projectiles, & Mission Setter



Approved for Public Release, PAO 614-10, dated 18 May 2010, 22 CFR 125.4(b)(13) applicable

A premier aerospace and defense company

**M777A2 Lightweight Towed Howitzer**

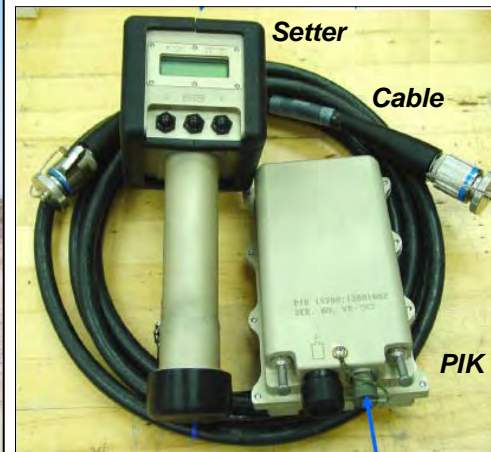


**M109A6 Paladin Self-Propelled Howitzer**



## Projectiles

- **M107**
  - 95 lbs, 15 lb warhead
  - Range with PGK 6-17km
- **M795**
  - 103 lbs, 23.8 lb warhead
  - Range with PGK 7-21.2km
- **M549A1**
  - 96 lbs, 15 lb warhead
  - Rocket assisted
  - Range with PGK 9-27.7km



**Enhanced  
Portable  
Inductive  
Artillery Fuze  
Setter  
(EPIAFS)**

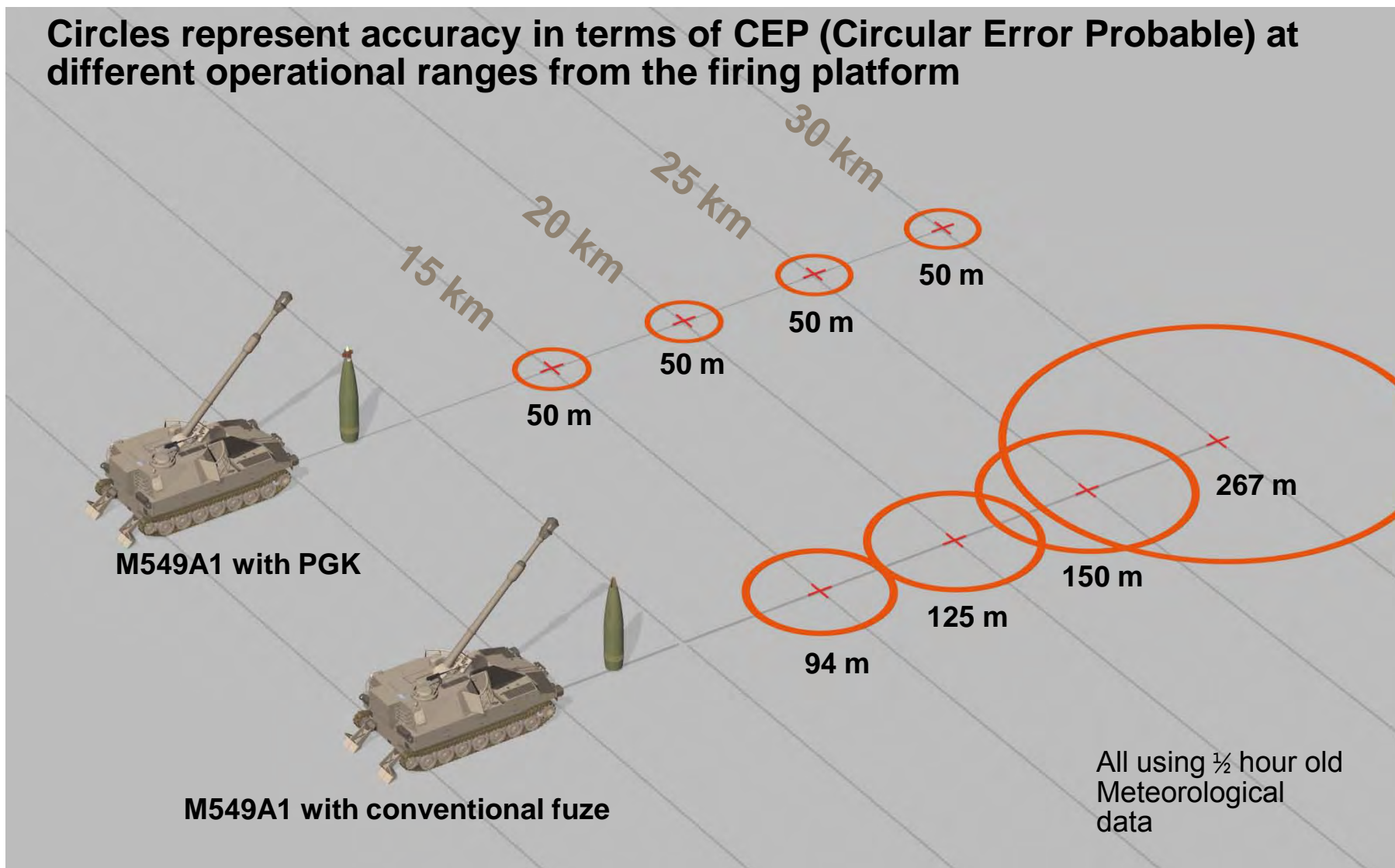


# Accuracy Comparison



A premier aerospace and defense company

Circles represent accuracy in terms of CEP (Circular Error Probable) at different operational ranges from the firing platform



- **Technology Demonstration Contract Award – June 2006**
- Competitive Shoot-Off – April 2007
- **System Development & Demonstration Contract Award – May 2007**
- Preliminary Design Review – November 2007
- First Form-Factored Guided Flight Test – Oct 2008 (26m from target)
- Critical Design Review – January 2009
- Gov't End-to-End Interoperability Demo – April 2009
- First Guided Flight Test Using EPIAFS for Initialization – June 2009
- First Live Fire Tests – Aug 2009
- Final Contractor Qualification Tests with Gov't Fire Control – March 2010

**Fired 166 Form-Factored PGKs to Date**



# PGK Major Milestones (continued)



A premier aerospace and defense company

- Gov't Insensitive Munitions Tests – Complete



- Gov't Electromagnetic Environmental Tests – Complete



- Gov't SET-S and SET-P Tests – In Process at Yuma Proving Ground
- Gov't Transportation Handling Qualification Tests – July 2009
- Gov't Milestone C – July 2009
- Gov't Air-Drop Certification Tests – Aug 2009

**On Track for MS-C in July and Production FAAT Build in August**



# Gov't End-To-End Interoperability Demo

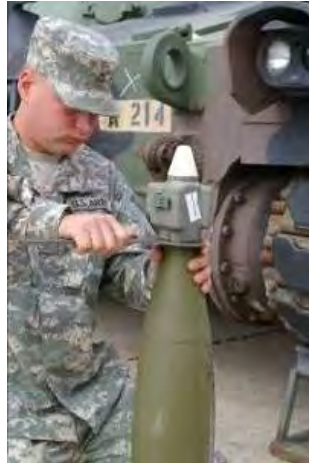


A premier aerospace and defense company

## Preparation for Firing – LW155



Remove PGK from Ammo Can



Install PGK on Round



### Set PGK with EPIAFS



Remover PGK Cover



### Load Round into Gun



# Recent Live Fire Test Results (PD and PROX)



Approved for Public Release, PAO 614-10, dated 18 May 2010, 22 CFR 125.4(b)(13) applicable

A premier aerospace and defense company

## PD (Point Detonation) Mode



M549 Projectile  
Fired at cold temp (-25°F)  
19.8km Range  
MACS-4 Charge

## PROX (Proximity) Mode



M549 Projectile  
Fired at hot temp (145°F)  
19.8km Range  
MACS-4 Charge





# PGK is Affordable Precision



Approved for Public Release, PAO 614-10, dated 18 May 2010, 22 CFR 125.4(b)(13) applicable

A premier aerospace and defense company

## PGK (PRECISION GUIDANCE KIT)

INSTALLS IN FUZE WELL

SIMPLE AND RUGGED

ONE MOVING PART

NO BATTERY REQUIRED

GPS ACCURACY

SAASM

FULL CONTINUOUS 2D GUIDANCE





# Contact Information

Tom Bybee  
PGK Technical Director  
ATK Advanced Weapons  
Plymouth, MN  
763.744.5108  
tom.bybee@atk.com



## Innovation ... Delivered.

Precision Guidance Kit (PGK) for Artillery

Approved for Public Release, PAO 614-10, dated 18 May 2010, 22 CFR 125.4(b)(13) applicable

# Expeditionary Maneuver Warfare & Combating Terrorism S&T Department

Code 30



## Joint Armaments Conference

Mr. George Solhan  
Deputy Chief of Naval Research,  
Expeditionary Maneuver Warfare  
and  
Combating Terrorism (ONR 30)  
18 May 2010



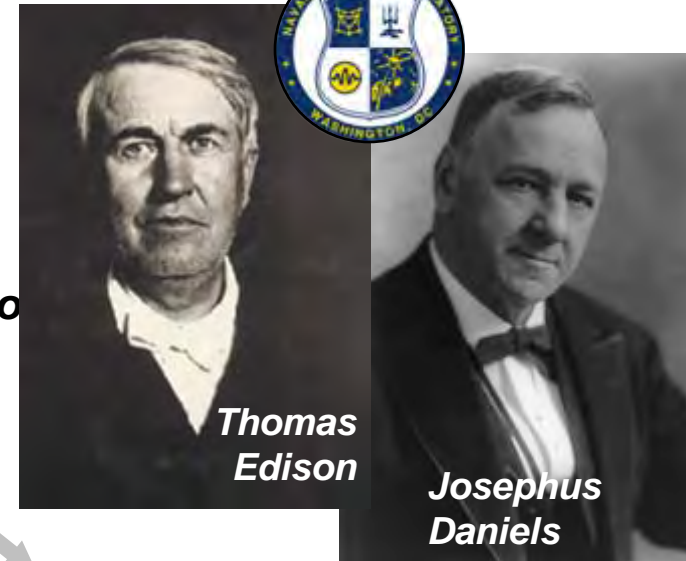
# Naval Research: A Statutory Mission

Naval Research Laboratory (Appropriations Act, 1916):  
*“[Conduct] exploratory and research work...necessary...  
for the benefit of Government service, including the  
construction, equipment, and operation of a laboratory....”*

Office of Naval Research (Public Law 588, 1946):  
*“... plan, foster, and encourage scientific research  
in recognition of its paramount importance as related to  
the maintenance of future naval power, and the  
reservation of national security.... ”*



Harry S  
Truman



Thomas  
Edison

Josephus  
Daniels

Transitioning S&T (Defense Authorization Act, 2001):  
*“...manage the Navy’s basic, applied, and advanced  
research to **foster transition** from science and  
technology to higher levels of research, development,  
test, and evaluation.”*





# ONR S&T Departments

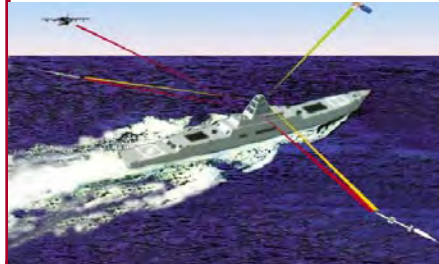
## Code 30



**Expeditionary Maneuver  
Warfare & Combating Terrorism**

## Code 31

### C4ISR



## Code 32

### Ocean Battlespace Sensing



### Sea Warfare and Weapons



## Code 33

### Warfighter Performance



## Code 34

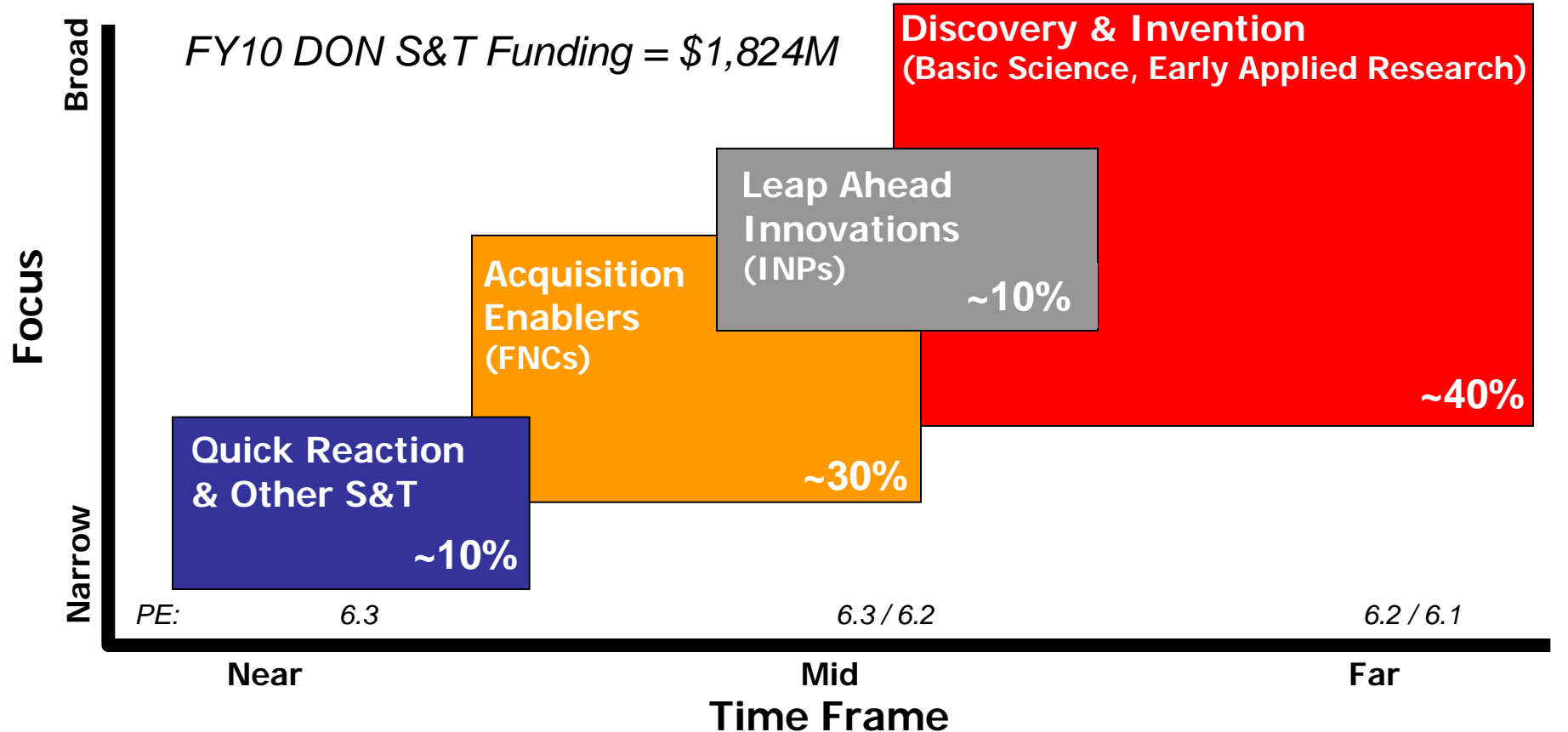
### Air Warfare and Weapons



## Code 35



# S&T Focused on Naval Needs



## Quick Reaction (10%)

- Tech Solutions
- Experimentation
- MC S&T (MCWL, JNLW, etc.)

## Acquisition Enablers (36%)

- Future Naval Capabilities
- Warfighter Protection
- Capable Manpower
- LO/CLO

## Leap-Ahead Innovations (12%)

- Innovative Naval Prototypes
- NSPs
- Swampworks

## Discovery & Invention (42%)

- Basic & Early Applied Research
- National Naval Responsibilities
- Education Outreach HBCU/MI



# ONR 30 Organization

## Expeditionary Maneuver Warfare and Combating Terrorism S&T

Human, Social, Cultural, and Behavioral Sciences (HSCB)

### Hybrid Complex Warfare Sciences Division (301)

Basic Research Counter IED

### Applications Division (302)

FITE JCTD

### Combating Terrorism & Integration Division (303)

Maritime Irregular Warfare

Operational Adaptation + HSCB

### FY2011 R2 Activity Areas & ONR Code 30 Thrust Areas

HPT&E\* Thrust

C4 Thrust

ISR Thrust

Fires Thrust

Logistics Thrust

Maneuver Thrust

Force Protection Thrust

### ONR Code 30 Technology Investment Areas – Focused Thrust Level S&T Investments

- ✓ Enhanced Physical Readiness
- ✓ Mental Resilience & Cognitive Agility
- ✓ Expertise Development

- ✓ Network Centric Warfare -Interoperability
- ✓ Over-The-Horizon Comms & Gateways
- ✓ Small Unit Technologies

- ✓ Persistent ISR
- ✓ Knowledge Generation
- ✓ ISR - C2 (Actionable Intelligence)
- ✓ Biometrics
- ✓ Tag, Track & Locate

- ✓ Targeting & Engagement
- ✓ Advanced Ammo
- ✓ Advanced Weapons

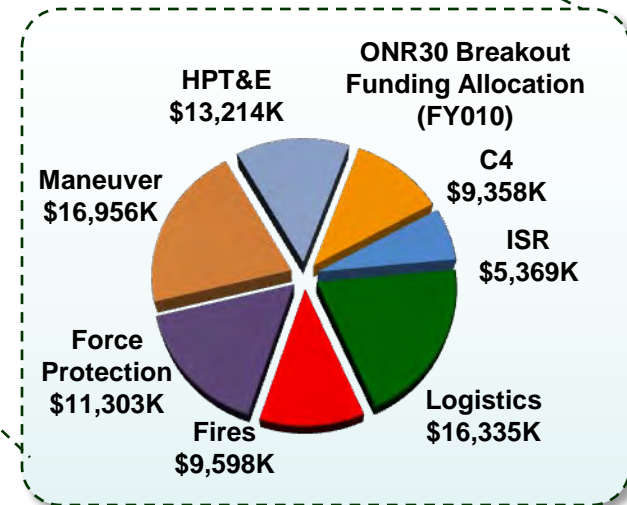
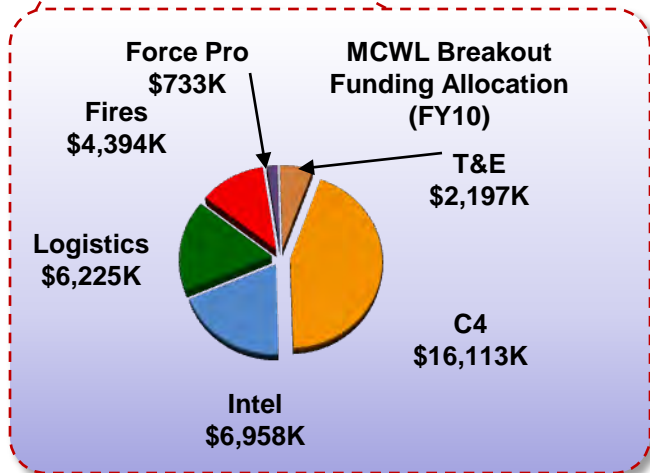
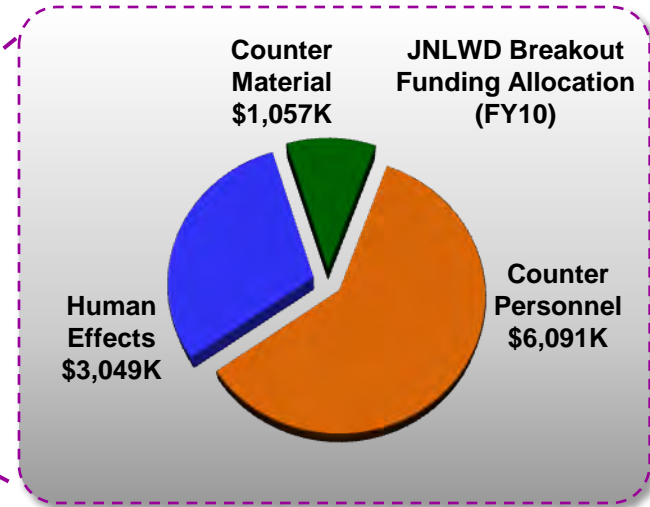
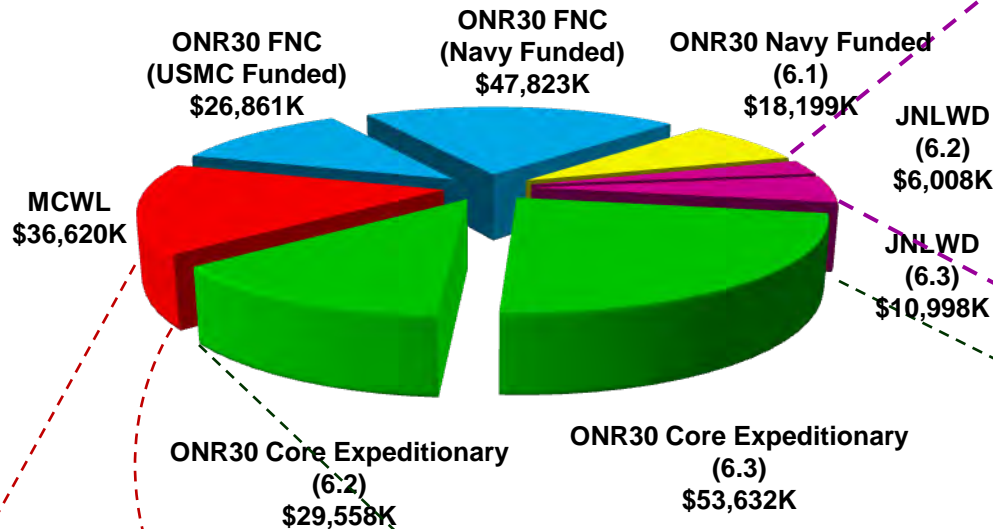
- ✓ Asset Visibility
- ✓ Logistics Transport
- ✓ Operational Self-Sufficiency
- ✓ Maintenance Reduction
- ✓ Infrastructure

- ✓ Survivability
- ✓ Advanced Mobility
- ✓ Maneuver Enablers

- ✓ Detection
- ✓ Neutralization
- ✓ Mitigation



# FY10 Marine Corps Funding Allocation





The glass is half full!



ONR

The glass is half empty.



SYSCOM

Half full...No! Wait!  
Half empty!...No, half...  
What was the question?



MCCDC/OPNAV

Hey!  
I ordered a cheeseburger!



Fleet/MARFOR





# Distributed Operations Defined



“Distributed operations describe an operational approach that creates an advantage over an adversary through **the deliberate use of separate, coordinated and interdependent actions**. Distributed operations are **enabled by improved access to functional support, as well as by enhanced combat capabilities at tactical levels**. Distributed operations are essentially a form of maneuver warfare in all domains and dimensions.” -- *Major Combat Operations Joint Operating Concept*



“Distributed operations is a technique applied to an appropriate situation wherein **units are separated beyond the limits of mutual support**. Distributed Operations are **practiced by general purpose forces, operating with deliberate dispersion, where necessary** and tactically prudent, and **decentralized decision-making** consistent with the commander’s intent to achieve advantages over an enemy in time and space...” -- *Marine Corps Ops in Complex & Distributed Environments (concept paper)*

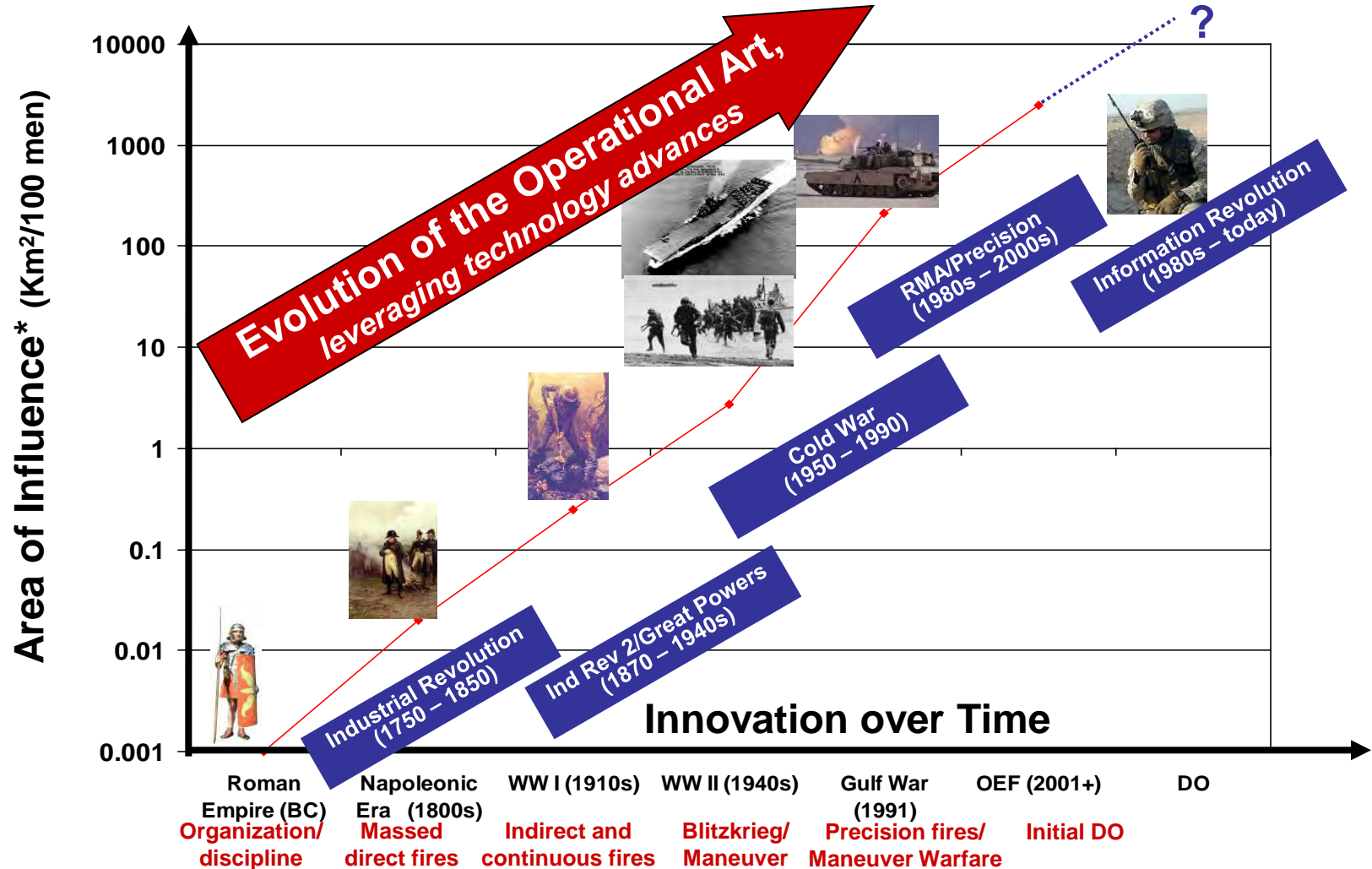


“[The] Navy’s current operating environment drives us to adopt **distributed, networked operations** as our overarching global Navy concept. [This concept] takes advantage of the Navy’s persistent forward posture to support active, layered defenses while placing the Navy-Marine Corps team in a unique position to conduct the shaping operations needed to assure friends and allies, and dissuade or deter potential regional, transnational, or global competitors.” -- *Navy Strategic Plan, 2006*



# Technology Transforms Operational Art

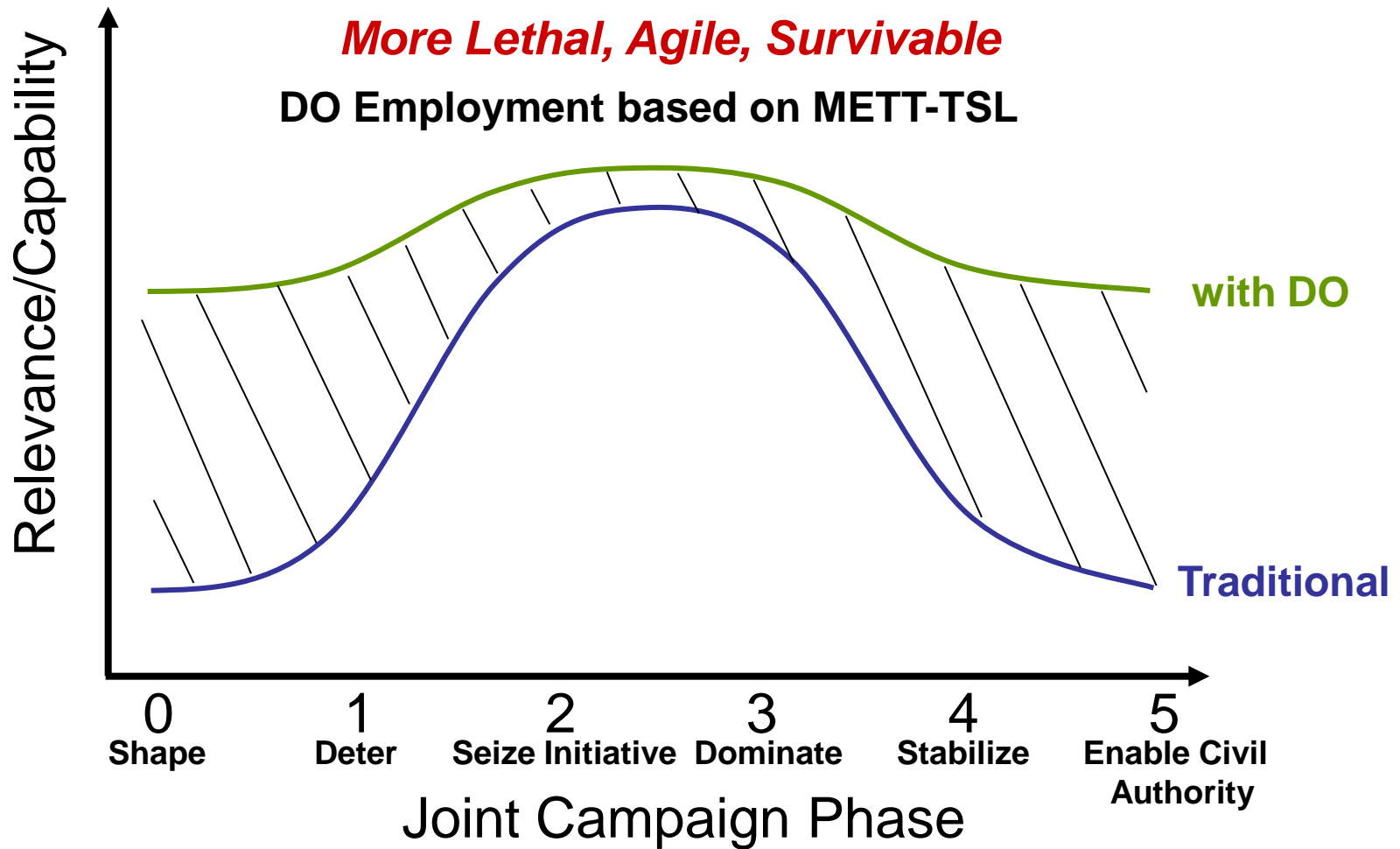
DO is the next logical step in a historical progression toward increased dispersion.







# DO Relevance in Joint Operations



“Armies do not win wars by means of a few bodies of super-soldiers but by the quality of their standard units”

Field Marshall Sir William Slim



# Distributed Operations

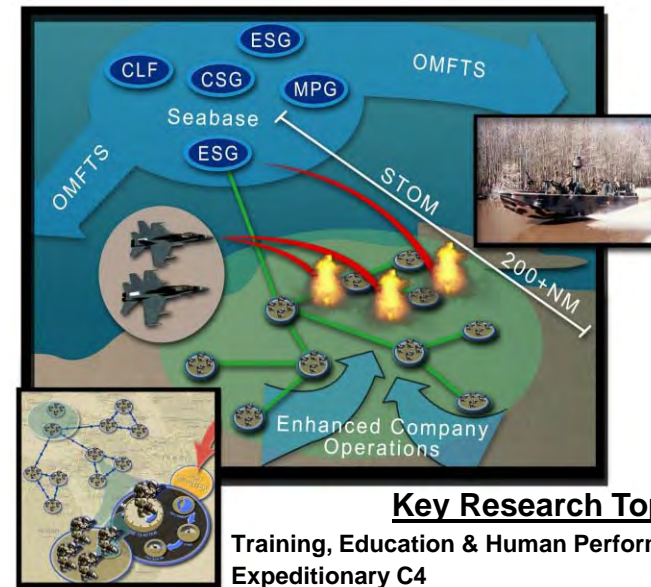
## Vision & Objectives

### Vision

Enable dispersed small units to dominate an extended battlespace through advanced warfighter training, assured network connectivity, enhanced situational awareness, and guaranteed access to logistics and fire support.

### Objectives

1. **Warfighter Preparation:**
  - 1.1 Optimized physical readiness and enhanced cognitive performance
  - 1.2 Immersive, synthetic systems for training and education
2. **Command & Control:**
  - 2.1 Robust communications networks
  - 2.2 Enhanced small-unit situational awareness through intelligence and alert dissemination
  - 2.3 Small unit blue force tracking systems
3. **Logistics:**
  - 3.1 Automated logistics planning and monitoring
  - 3.2 Sustained demand reduction
  - 3.3 Logistics delivery
4. **Mobility:**
  - 4.1 Individual mobility & combat load reduction
  - 4.2 Small-unit mobility
5. **Lethality and Survivability:**
  - 5.1 Enhanced organic small-unit weapons effects
  - 5.2 Enhanced small-unit surveillance and reconnaissance



### Key Research Topics

Training, Education & Human Performance  
Expeditionary C4  
Communications and Networks  
Expeditionary Logistics  
Expeditionary Firepower  
Precision Strike  
Expeditionary ISR  
Unmanned Air and Ground Vehicles  
Special Warfare / EOD  
Land Mine Countermeasures  
Expeditionary Maneuver/ Individual Mobility



# Fires as a Commodity

## Technology Investment Areas (TIA):

Targeting and Engagement

Advanced Ammunition

Advanced Weapons

## Netted:

- Shared Situational Awareness throughout sensor-to-shooter chain
- Ability to mass fires

Reliable

Accurate

Lethal (Scalable)

Responsive

Flexible

Inorganic

Bomb Damage Assessable

Logistically Supportable

“Lighten the Load”



# Targeting and Engagement TIA

## Precision Urban Mortar Attack (PUMA)



**Fire Support  
Coordination Center  
(FSCC)**

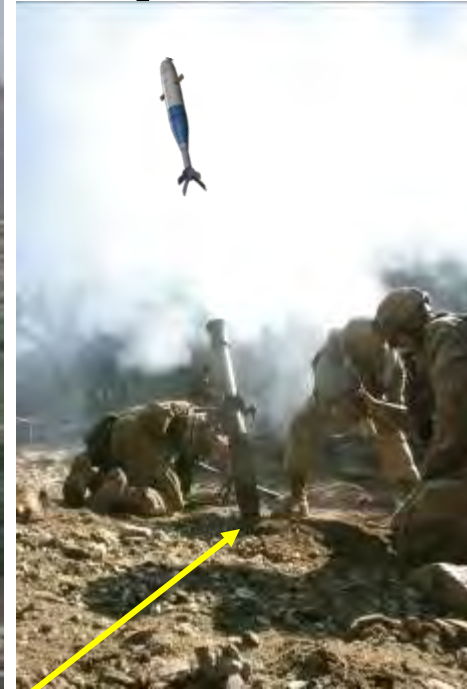




# Targeting and Engagement TIA



## Precision Urban Mortar Attack (PUMA)



**Fire Support  
Coordination Center  
(FSCC)**

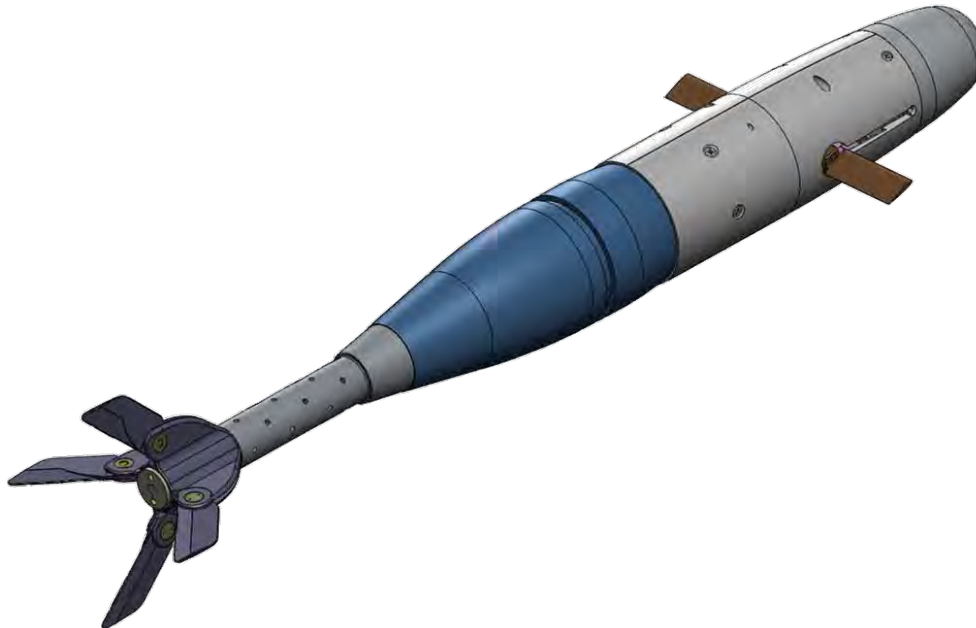
**Fire Direction Center  
(FDC)**



# Targeting and Engagement TIA

- **Flight Controlled Mortar (FCMortar):**

- Guidance kit for 81mm mortar system, for precision engagement of targets in deep defilade
- Flight trajectory shaping, miniature guidance and control components





# Targeting and Engagement TIA

- **Non-magnetic Azimuth Sensing (NMAAS):**
  - Handheld azimuth sensor for targeting, to 1 mil accuracy
  - System accuracy in operational environments
- **Eye-safe Laser Designation (ESLD):**
  - Handheld, eye-safe laser designator and seeker for covert targeting and engagement
  - Detector responsivity at eye-safe wavelength





# Targeting and Engagement TIA

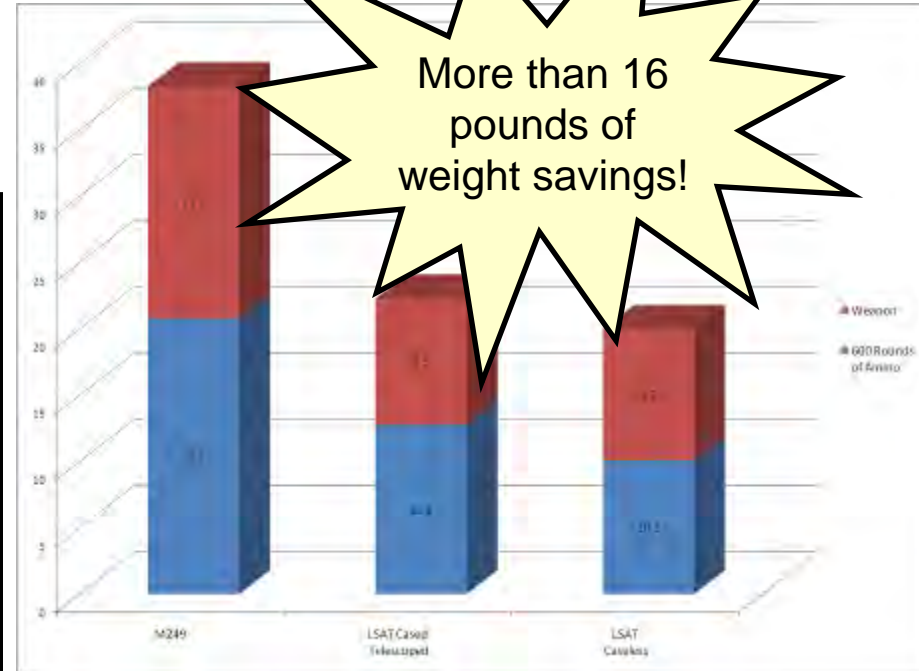
- **Integrated Day-Night Sight Technology (IDNST):**
  - Integrated Vis-NIR-SWIR-LWIR optics in a single sight package; version for individual weapons, version for crew served weapons
  - Seek, acquire, track, observe, and engage targets to weapons' maximum effective ranges, under all light levels, through smokes and aerosols
  - Electromagnetic spectrum integration in a lightweight system
  - Lighten the load: reduce size, weight, and power





# Advanced Ammunition TIA

## Lightweight Small Arms Technologies (LSAT)



	M855	Cased Telescoped	Caseless
Volume (cu in)	0.247	0.215	0.152
<b>Percent Volume Reduction</b>	----	<b>13%</b>	<b>38%</b>
Weight (grains) Including link	220	130.6	105.1
<b>Percent Weight Reduction</b>	----	<b>41%</b>	<b>51%</b>



Light Machine Gun (Comparable to M249 SAW)

5.56mm Case Telescoped

5.56mm Caseless



# Advanced Ammunition TIA

- **Extended Range Mortar Ammunition (ERMA):**
  - Increase range of the 81mm mortar by changing propellant formulation and granulation
  - Propellant formulations, interior ballistics, insensitive munitions
- **Physics Based Modeling of Novel Warhead Designs:**
  - Optimize initiation, explosives, materials, and shapes phenomenologies for warheads designed for specific effects on a variety of material targets
  - Computational/modeling capabilities of National Laboratories
- **Micro-electromechanical Systems (MEMS):**
  - Mortar Safety and Arming, ignition safety device
  - MEMS energetics



# Advanced Weapons TIA

- **High Performance Alloys for Weapons Applications (HPAWA):**
  - **Lighten the Load**
  - **Durability/Reliability**
  - **Cost Avoidance**
  - **Flowformed, lightweight, Cobalt Alloy machine gun barrels able to withstand high firing temperatures**
  - **Alloy characterization and fabrication**



# LSAT Cost Comparison

- **Cost to Replace Army and Marine Corps M249 SAW, M4, and M16:**

**\$1,300,000,000**

- **Cost of M1 Main Battle Tank:**

**\$5,000,000 each**

**Total: \$31,400,000,000**



- **Cost of F-22 Raptor:**

**\$143,000,000 each**

**Total: \$19,600,000,000**

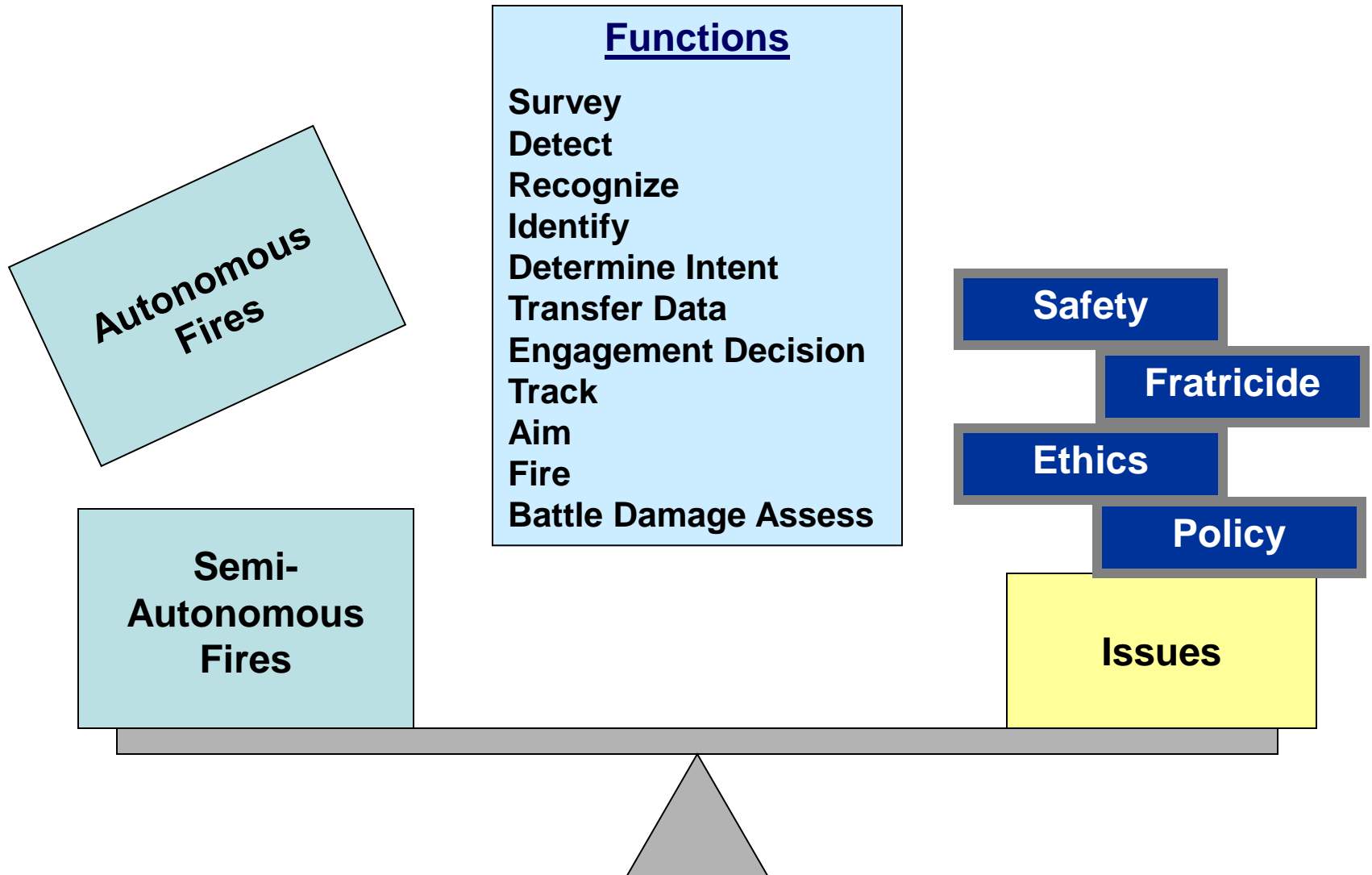


All costs are estimated



# Advanced Weapons TIA

## Autonomous Fires Systems



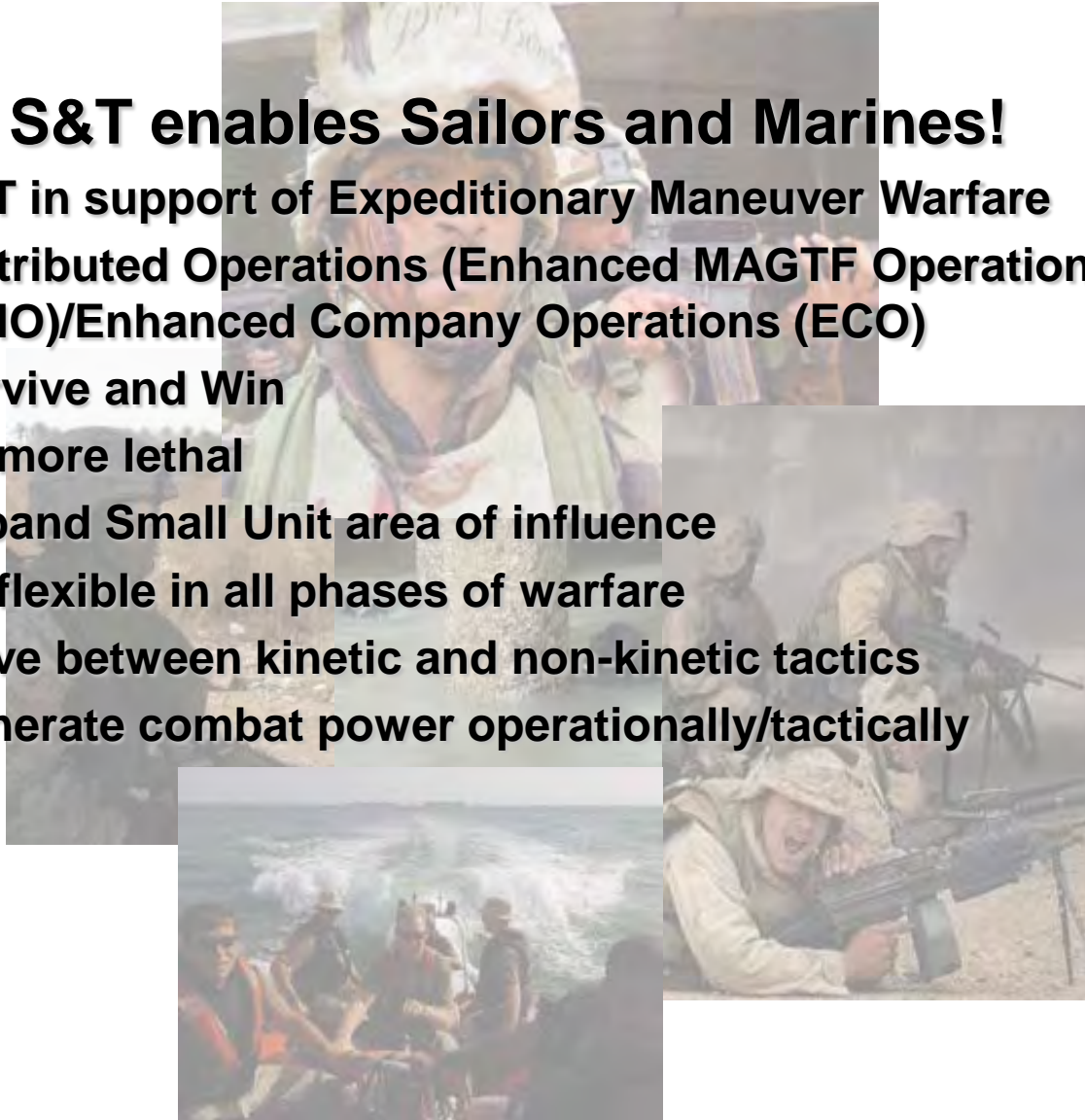




# The Ultimate Customer – The Warfighter!

## **ONR S&T enables Sailors and Marines!**

- **S&T in support of Expeditionary Maneuver Warfare**
- **Distributed Operations (Enhanced MAGTF Operations (EMO)/Enhanced Company Operations (ECO))**
- **Survive and Win**
- **Be more lethal**
- **Expand Small Unit area of influence**
- **Be flexible in all phases of warfare**
- **Move between kinetic and non-kinetic tactics**
- **Generate combat power operationally/tactically**





# Questions?



# Back-Up





# Targeting and Engagement TIA Willful Intent

## Current Capability:

- Conventional targeting and engagement systems for direct and indirect fire capability

FY	Desired Capability	S&T Challenge	S&T Solution
<b>Near Term</b> FY10-FY15	<ul style="list-style-type: none"> <li>- Precision fires for battalions</li> <li>- Accurate target location</li> <li>- Eye-safe, light weight, low-power target designation</li> <li>- Threat detection, recognition, and identification out to effective ranges of small arms and crew served weapons</li> </ul>	<ul style="list-style-type: none"> <li>- Develop a miniature guidance, navigation, and control system for a 81mm mortar</li> <li>- Develop miniature azimuth sensors with 1mil accuracy</li> <li>- Develop low power eye safe laser designator technologies</li> <li>- Develop advanced Focal Plane Arrays (FPA), having miniature displays, applying scene enhancement technologies</li> </ul>	<ul style="list-style-type: none"> <li>- GPS and terminal seeker based guidance kit and tail kit for the M821/M889 81mm mortar munitions</li> <li>- Miniature Micro-electromechanical Systems (MEMS) based inertial azimuth sensors</li> <li>- Micro pulsed laser range finder and pulse integrating seeker technologies and algorithms</li> <li>- Integrated Vis-NIR-SWIR-LWIR optics in a single sight package through the Future Naval Capability (FNC) program</li> </ul>
<b>Mid Term</b> FY15-FY18	<ul style="list-style-type: none"> <li>- Precision fires for companies</li> <li>- Remotely deployed tags to mark hostile vehicles and combatants</li> <li>- Day and night wide Field of View (FOV) target acquisition for crew served weapons</li> </ul>	<ul style="list-style-type: none"> <li>- Develop a miniature guidance, navigation, and control system for a 60mm mortar</li> <li>- Develop rapidly dispersed aerosols or MEMS to attack to targets</li> <li>- Develop Graduated Index of Refraction (GRIN) lenses coupled to curved FPA</li> </ul>	<ul style="list-style-type: none"> <li>- GPS and terminal seeker based guidance kit and tail kit for the M720/M888 60 mm Mortar</li> <li>- Flight controlled mortar delivering aerosol/MEMS tags on designated standoff site</li> <li>- Combine GRIN lens, curved FPA, and advanced signal processing on Crew served weapons to provide day/night target acquisition</li> </ul>
<b>Far Term</b> FY18-FY22	<ul style="list-style-type: none"> <li>- Precision fires for the individual warfighter</li> <li>- Day and night wide FOV target acquisition for individual dismounted warfighters</li> </ul>	<ul style="list-style-type: none"> <li>- Develop guidance, navigation, and control technologies to flight correct small caliber projectiles</li> <li>- Develop nano- and doping-technologies for small sights, for individual weapons</li> </ul>	<ul style="list-style-type: none"> <li>- Micro-thrusters and MEMS based GNC for minor caliber and small arms ammunition</li> <li>- Miniaturized GRIN lens, curved focal plane array to provide small sight</li> </ul>

**Endstate:** Advanced targeting and engagement capabilities, enabling responsive and flexible Fires as a Commodity to individual warfighters, netted for shared situational awareness throughout the sensor-to-shooter chain, providing precision fires and massed fires ability, against unconventional and hybrid threats across the full range of military operations and environments.





# Advanced Ammunition TIA Willful Intent

## Current Capability:

- Conventional munitions for direct and indirect fire capability

FY	Desired Capability	S&T Challenge	S&T Solution
<b>Near Term</b> <b>FY10-FY15</b>	<ul style="list-style-type: none"> <li>- Extended range fires for battalions</li> <li>- Enable defeat of all targets in urban terrain and other complex types of terrain</li> <li>- Improve munitions reliability and first round Probability of Kill (<math>P_K</math>)</li> <li>- Reduce weight and logistics burden of ammunition</li> </ul>	<ul style="list-style-type: none"> <li>- Develop advanced propellant technologies for the 81mm mortar</li> <li>- Develop novel warhead technologies that combine kill mechanisms for various target sets</li> <li>- Improve the reliability and output of safe-arm and ignition devices</li> <li>- Reduce small caliber ammunition weight by 50% and volume by 40%</li> </ul>	<ul style="list-style-type: none"> <li>- High nitrogen propellants and new propellant formulations</li> <li>- Combine conventional kill mechanisms including linear explosively formed penetrators, a shaped charge, a unitary penetrator, high explosive, and fragments in a single warhead</li> <li>- Miniature MEMS based low-energy reactive bridges and safe-arm technologies</li> <li>- High ignition temperature propellant, PNP binder replacement, and improved primer technologies for advanced caseless small caliber ammunition</li> </ul>
<b>Mid Term</b> <b>FY15-FY18</b>	<ul style="list-style-type: none"> <li>- Extended range fires for companies</li> <li>- Defeat of targets behind walls (both combatants and doubly protected items)</li> <li>- Insensitive primary explosives and fuzes for advanced warheads</li> </ul>	<ul style="list-style-type: none"> <li>- Develop advanced propellant technologies for the 60 mm mortar</li> <li>- Develop advanced warheads and fuzes that delay detonation until the penetrator enters the protected space</li> <li>- Develop high output explosives with low sensitivity</li> </ul>	<ul style="list-style-type: none"> <li>- High nitrogen propellants and new propellant formulations</li> <li>- Physics based modeling and optimization of advanced penetrating warheads, combining multiple effects (i.e. Munroe, Misznay-Schardin, spall, etc)</li> <li>- Porous chromium oxide matrices that control the ignition and detonation of high output explosives combined with advanced nano-circuits for reduced explosive sensitivity</li> </ul>
<b>Far Term</b> <b>FY18-FY22</b>	<ul style="list-style-type: none"> <li>- Extended range fires for individual warfighters</li> <li>- Scalable warhead effects for shoulder launched missiles and mortars</li> </ul>	<ul style="list-style-type: none"> <li>- Develop propulsion technologies for extending range for guided projectiles</li> <li>- Develop warhead configurations enabling scalable lethality</li> </ul>	<ul style="list-style-type: none"> <li>- Nano-materials for propellant with significant advantages in propulsion output</li> <li>- Unique configurations of MEMS based fuzing, variable output explosives, and advanced kill mechanism combinations</li> </ul>

**Endstate:** Improved lethality (scalable) and dominance of the individual Warfighter within his area of influence through advanced warhead, propulsion, and ammunition technologies, supporting Fires as a Commodity.

# Advanced Weapons TIA Willful Intent

## Current Capability:

- Conventional weaponry for direct and indirect fire capability

FY	Desired Capability	S&T Challenge	S&T Solution
<b>Near Term</b> FY10-FY15	<ul style="list-style-type: none"> <li>- Reduce the weight of weapon systems and components</li> <li>- Extend the service life of weapon systems</li> <li>- Coordinated threat response with remote weapons stations</li> </ul>	<ul style="list-style-type: none"> <li>- Develop new manufacturing processes that improve characteristics of materials used in weapon systems</li> <li>- Develop an integrated tactical network of threat detection sensors and remote weapons systems on moving vehicles</li> <li>- Demonstrate the utility of reducing combat load by increasing warfighter "kills-per-kilogram"</li> </ul>	<ul style="list-style-type: none"> <li>- High performance alloys and novel manufacturing methods</li> <li>- Acoustic sensors, advanced radios, and stabilized remotely operated weapon stations</li> <li>- Caseless ammunition small caliber weapons technologies</li> </ul>
<b>Mid Term</b> FY15-FY18	<ul style="list-style-type: none"> <li>- Improved life cycle performance for small arms (reduced barrel erosion, improved operational performance)</li> <li>- Affordable fires accuracy and lethality against small tactical platforms from small manned tactical platforms</li> <li>- Covert tagging of enemy vehicles and combatants</li> </ul>	<ul style="list-style-type: none"> <li>- Develop new materials and materials production techniques to provide consistent high weapon performance</li> <li>- Develop a remotely operated, stabilized weapon station mount of less than 200 lbs</li> <li>- Develop tag dispersion techniques that provide more than 95% coverage of all targets within 25m diameter from 2 km standoff range</li> </ul>	<ul style="list-style-type: none"> <li>- Flow-form processing, super alloys, and advanced composite materials</li> <li>- Integration of micro-pulsed laser designator, integrated day-night optics, lightweight minor caliber weapons, and low cost missiles</li> <li>- Airburst warhead for 81mm mortar with infrared reflective and other unique signature tagging technologies</li> </ul>
<b>Far Term</b> FY18-FY22	<ul style="list-style-type: none"> <li>- High velocity launch for kinetic kill projectiles to defeat future armor systems</li> <li>- Non-lethal fires</li> <li>- Precision engagement and escalation of force from unmanned ground, air, and surface platforms</li> </ul>	<ul style="list-style-type: none"> <li>- Increase projectile velocities beyond chemical property limits of current propellants to velocities in excess of 4 km/s</li> <li>- Develop inexpensive non-lethal weapons effects and munitions, in coordination with Joint Non-lethal Weapons Directorate (JNLWD)</li> <li>- Develop wireless lethal effectors for safe and legally permissible employment from unmanned platforms</li> </ul>	<ul style="list-style-type: none"> <li>- Combustion light gas gun using hydrogen and oxygen for propulsion</li> <li>- Directed energy, electromagnetic pulse generators, variable density projectiles, and phaser technologies</li> <li>- Null latency targeting and C2 technologies, autonomous on-board target recognition algorithms</li> </ul>

**Endstate:** Lightweight, reliable, accurate weapons systems, enabling organic and inorganic scalable lethality Fires as a Commodity, against diverse unconventional and hybrid threats, with the ability to escalate from non-lethal to lethal force from ground, air, and naval platforms, across the full range of military operations.



# FIRES

Discovers and develops technologies to provide decisive, unrivaled new capabilities for, or to improve the performance of Navy and Marine Corps warfighters in the areas of Fires; with particular focus on Distributed Operations and Asymmetric/Irregular Warfare; to include Naval Expeditionary and other weapons, munitions, fuzes, ballistics, propulsion, weapons systems control and guidance, enhanced accuracy, tailored lethality including non-lethal alternatives, enhanced targeting (to include detection, locating, identification, designation, and tracking), directed energy, and lightweight components; and to avoid technological surprise.

KEY: Other FNC D&I E&D Plus-Up

ONR

MANAGER

Dan Simons  
(703) 696-4840  
[dan.simons@navy.mil](mailto:dan.simons@navy.mil)

TEAM

Lee Beale  
(703) 696-5448  
[richard.beale@navy.mil](mailto:richard.beale@navy.mil)

Sheila Adkins  
(703) 696-0705  
[sheila.adkins.ctr@navy.mil](mailto:sheila.adkins.ctr@navy.mil)

TDA

Paul C. Conolly  
(540) 653-2004  
[paul.conolly@navy.mil](mailto:paul.conolly@navy.mil)

RECENT TRANSITIONS

IMPROVED FIRE CONTROL SYSTEM (FNC)

TRANSITIONED TO PM INFANTRY WEAPONS SYSTEMS

LIGHTWEIGHT MORTAR SYSTEM (FNC)

TRANSITIONED TO PM MORTARS & PM INFANTRY WEAPONS SYSTEMS

ADVANCED FIRES COORDINATION TECHNOLOGY

TRANSITIONED TO PM MAGTF C2

ADVANCED GUN BARREL TECHNOLOGY

TRANSITIONED TO PEO-IWS3c

MEMS SAFE & ARM

TRANSITIONED TO PM AMMO

## TECHNOLOGY INVESTMENT AREAS

### TARGETING & ENGAGEMENT

**USMC Fires STO-1:** Targeting technologies for faster, more precise engagements, while simplifying fire control tasks

**USMC Fires STO-2:** Integrated lightweight day-night optics

**USMC Fires STO-3:** Engagement damage assessments

**USMC Fires STO-4:** More capable, lighter weight ammunition across the spectrum of lethality, with increased reliability, range, precision, and safety

**USMC Fires STO-6:** Increased capabilities and reduced weight of all ground combat weapons systems

**USMC Fires STO-7:** Technologies that utilize the electromagnetic spectrum to detect, exploit and target adversary systems, equipment, or individuals

**NECE Fires STO-6:** Lightweight day-night optics

**NSW Fires 09-7:** Lightweight, All Weather, Precision Targeting Technologies

**NSW Fires 09-9:** Lightweight Day-Night Weapons Optics

**NSW Fires 09-13:** Munitions Terminal Guidance for NSW Applications

**NSW Fires 09-16:** Highly Responsive Loitering Munitions/Weaponized UAS

**NSW Fires 09-18:** Advanced Weapons and Propellant Technologies

## PROJECTS

IMPROVED FIRE CONTROL SYSTEM (IFCS)	DISTRIBUTED OPERATIONS PRECISION ENGAGEMENT (DOPE)
NON-MAGNETIC AZIMUTH SENSING (NMAS)	INTEGRATED DAY/NIGHT SIGHT TECHNOLOGY (IDNST)
MICRO-PULSE LASER DESIGNATION	MEMS INERTIAL SENSORS (UC IRVINE)
FLIGHT CONTROLLED MORTAR	PRECISION ENGAGEMENT TECHNOLOGIES (PET)

# FIRES

Discovers and develops technologies to provide decisive, unrivaled new capabilities for, or to improve the performance of Navy and Marine Corps warfighters in the areas of Fires; with particular focus on Distributed Operations and Asymmetric/Irregular Warfare; to include Naval Expeditionary and other weapons, munitions, fuzes, ballistics, propulsion, weapons systems control and guidance, enhanced accuracy, tailored lethality including non-lethal alternatives, enhanced targeting (to include detection, locating, identification, designation, and tracking), directed energy, and lightweight components; and to avoid technological surprise.

KEY:

Other

FNC

D&I

E&D

Plus-Up

## TECHNOLOGY INVESTMENT AREAS

### ADVANCED AMMUNITION

**USMC Fires STO-4:** More capable, lighter weight ammunition across the spectrum of lethality, with increased reliability, range, precision, and safety

**USMC Fires STO-5:** Improved propellants and energetic materials

**USMC Fires STO-6:** Increased capabilities and reduced weight of all ground combat weapons systems

**NSW Fires 09-11:** Measured-Effect Munitions

**NSW Fires 09-12:** Clandestine Structure Penetration

**NSW Fires 09-18:** Advanced Weapons and Propellant Technologies

### ADVANCED WEAPONS

**USMC Fires STO-6:** Increased capabilities and reduced weight of all ground combat weapons systems

**NSW Fires 09-18:** Advanced Weapons and Propellant Technologies

## PROJECTS

**TACTICAL URBAN STRIKE WARHEAD (TUSW)**

**81mm EXTENDED RANGE MORTAR AMMUNITION (ERMA)**

**CASELESS AMMUNITION**

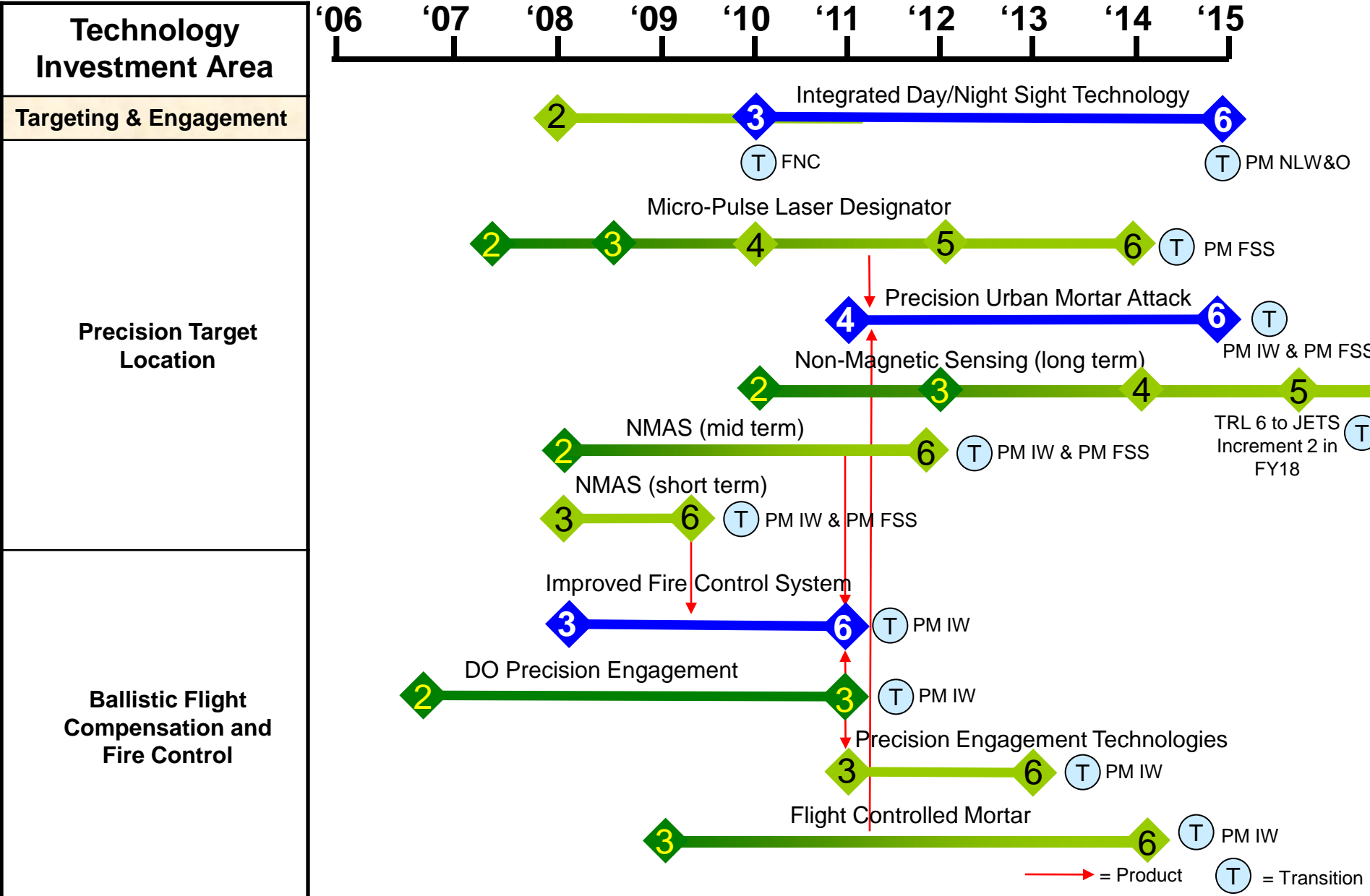
**1901 A IGNITION SAFETY DEVICE**

**REVOLUTIONARY TARGET EFFECTS**

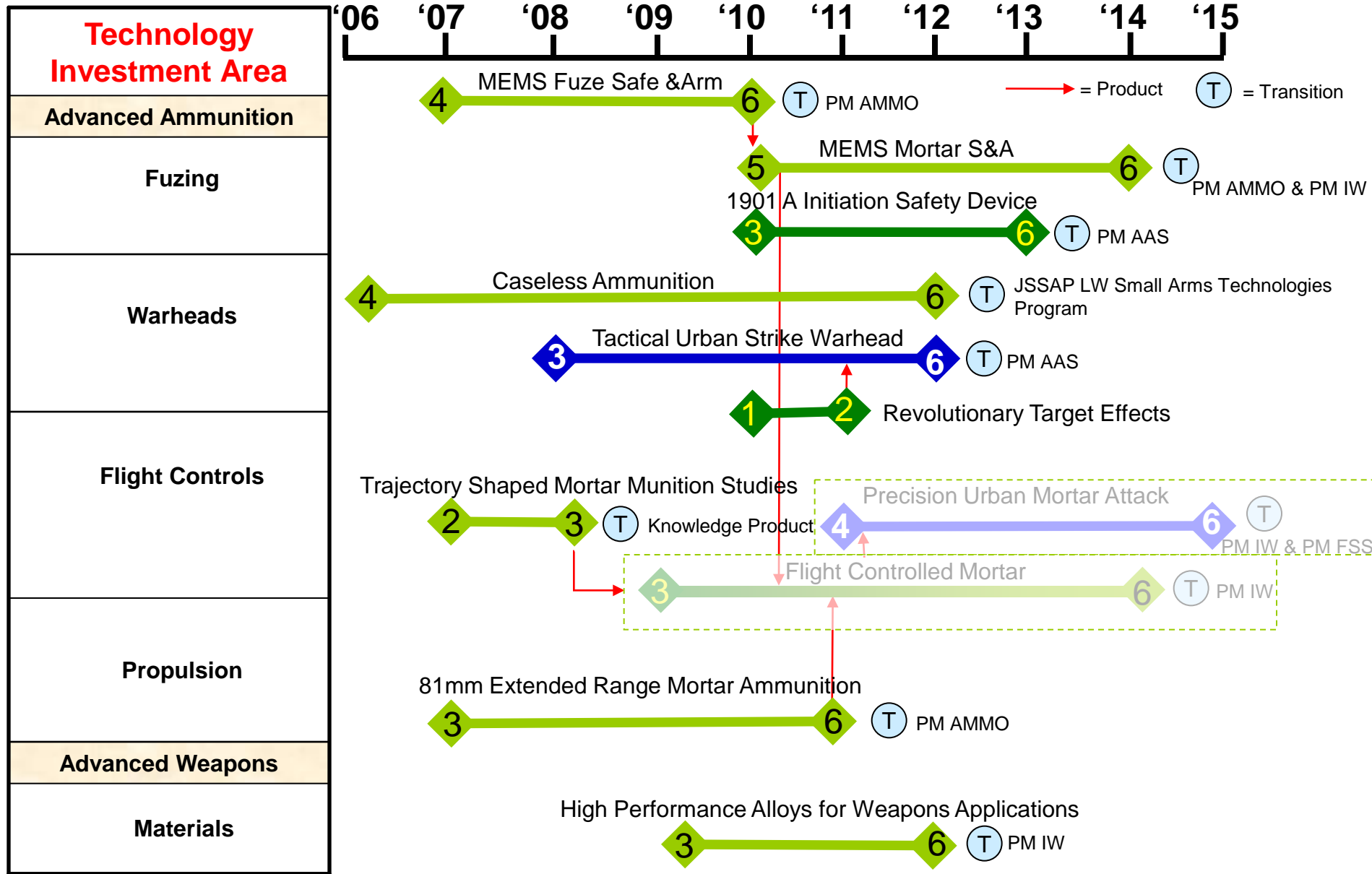
**MEMS MORTAR S&A**

**HIGH PERFORMANCE ALLOYS FOR WEAPONS APPLICATIONS**

# ONR 30 FIRES S&T Roadmap (1 of 2)



# ONR 30 FIRES S&T Roadmap (2 of 2)





# Netherlands Mission Experiences



## On Infantry Ammunition



Army



Marines



Afghanistan



Airforce



# Netherlands Mission Area

Afghanistan



**TFU** Task Force Uruzgan

Appr: 1.900 People

6 month rotations

**2008-2010**





# Netherlands **Armed Forces**



Airforce Base **Eindhoven**



Port **Eemshaven**



**Total Size:** **68.300**

-Army:	26.000
-Navy:	10.000
-Airforce:	10.000

**Population:** 16 Million

**Budget:** Appr 8,3 Billion €



Netherlands



# Camps

Camp Hadrian

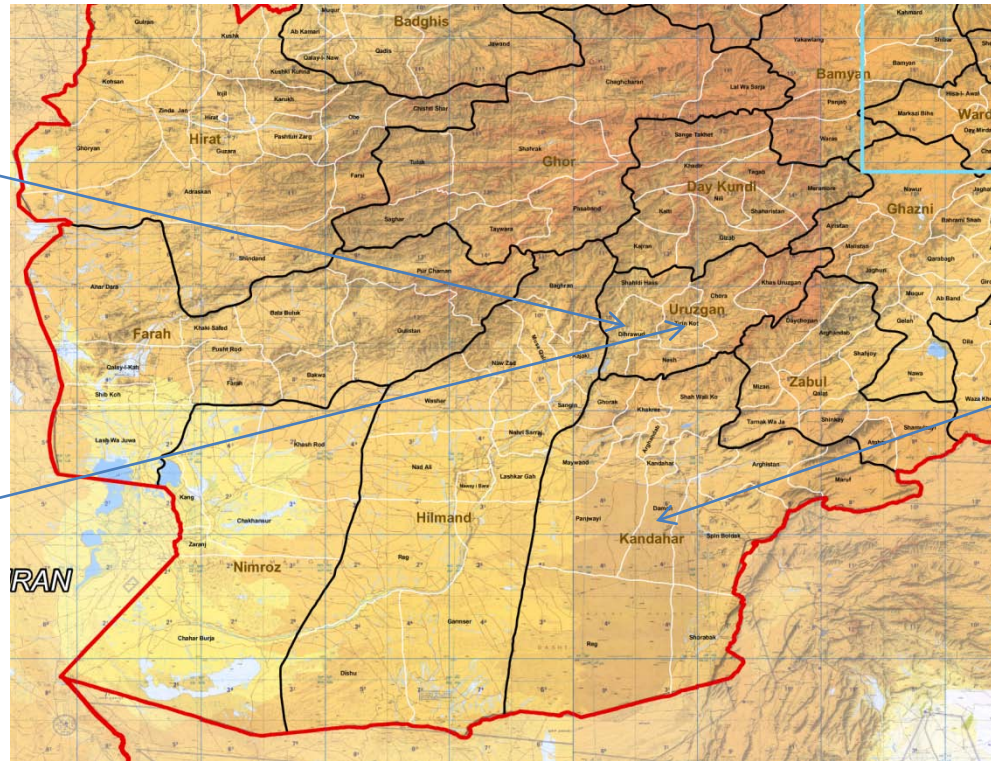
Deh Rawood



Tarin Kowt



Camp Holland



Kandahar

Airforce Base



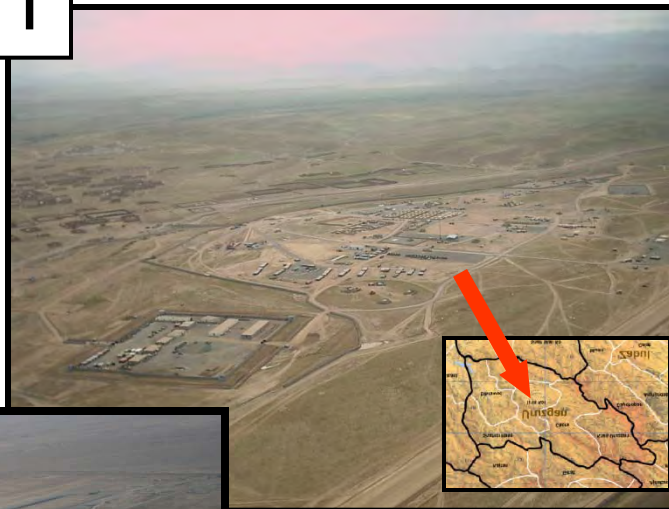
# Afghanistan



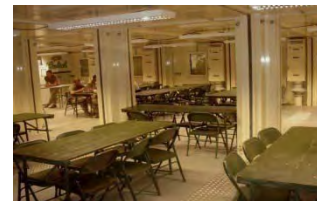
Kandahar



Deh Rawood



Tarin Kowd







# Netherlands

## Armed Forces

### To Afghanistan

6.000 km  
2 days

Airforce Base **Eindhoven**



Port **Eemshaven**

10.000 km  
25-45 days




KDC-10

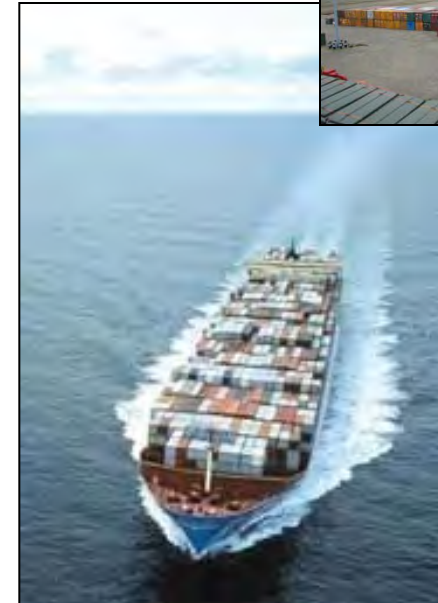


IL-76



C-17

 75.000 Kg; 500h  
Short landing track (1 km)





# Netherlands

## Mission Area

### Some Equipment in Afghanistan

#### For transport

C-130

(17.000 kg/128 passengers)



F16



Apache

#### For missions

YPR



MB



Patria



Fenek



Bushmaster



Convoy's



Cougar



PzH2000



Chinook



Viking





## Close Cooperation with ANA







Experiences

Ammunition



Extremely High Need for  
Ammunition

Ammunition:

**Need for high quantities**

**Need for good quality**

**Need for improved performance**  
(urban targets)





# TFU

## Experiences

### Infantry Ammunition

- **Small Caliber Ammunition** (upto 12,7 mm)
- **Medium Caliber Ammunition**
  - ✓ 25mmx137 for 25mm Canon IFV
  - ✓ 40mmx46 for Underslung and Stand Alone (Low Velocity)
  - ✓ 40mmx53 for AGL (High Velocity)
- **Mortar Ammunition**
  - ✓ 60mm
  - ✓ 81mm
- **AT/AS ammunition**
  - ✓ AT4
  - ✓ LAW M72A1
  - ✓ PzF / Bunkerfaust
  - ✓ Gill

### Storage





# TFU Experiences

## “Infantry Support” Weaponsystems (≡ Ammunition)

- **155mm PzH2000NL**
- **Apache AH-64D Helicopter**
  - ✓ 30mm HEDP
  - ✓ 2,75" Rockets
  - ✓ Hellfire Missiles
- **F16 A/B MLU Aircraft**
  - ✓ 20mm FAP (now M70 mix)
  - ✓ Bombs (laserguided/GPS)
  - ✓ Missiles (only Air-to-Air)



# TFU

## Experiences

### Other Infantry Ammunition

- Handgrenades



- Smoke grenades  
(vehicle protection)



Special Forces



# TFU Experiences

## MOUT Targets

### Quala's



Clay Walls (av. 80cm thick); Sundried, mixed with stones and other materials

# TFU

## Experiences

### Extreme Environment

Sandstorm



**HOT**



Winter conditions



**COLD**



# TFU Experiences

## Extreme Mistreatment of Ammunition



Tune Up the  
qualification  
programs ?



# TFU Experiences

## Small Caliber Ammunition (upto 12,7mm)



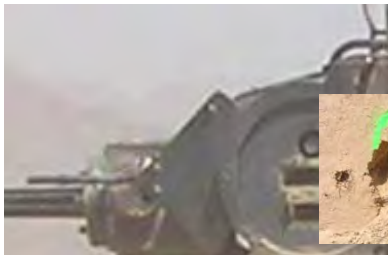
5,56mm



Diemaco  
Minimi



7,62  
COAX



7,62  
MAG



12,7mm



Shotgun

7,62mm



Long Range  
Rifles



8,6mm



12,7mm



High quantity use

Not very effective against Quala targets



# TFU

## Experiences

### Medium Caliber Ammunition



- ✓ 25mmx137 for 25mm Canon IFV
- ✓ 40mmx46 for Underslung and Stand Alone (Low Velocity)
- ✓ 40mmx53 for AGL (High Velocity)







**Malfunctioning**

25mm APDS-T, nr121

RWMS: TLB073  
Soft metal cartridge case

# TFU Experiences

**25mm Ammunition (IFV)**



Linked Ammo

Qualified for use  
upto +63 C



STANAG 4173



**High quantity use**

Initial quantity from:

**DNK & CND (C137)**



25mm APFSDS-T, nr554

RWMS: PLB090  
Hard metal cartridge case

# TFU

## Experiences

### 25mm Ammunition (IFV)



1 rnd  
No penetration



3 rnds  
Penetration

25mm APFSDS-T

**NOT very effective** against Quala targets  
**Effective at ranges > 2.000m** (other type of targets)



# TFU

## Experiences

### 40mmx53 High & Low Velocity Ranges



CIS 40GL



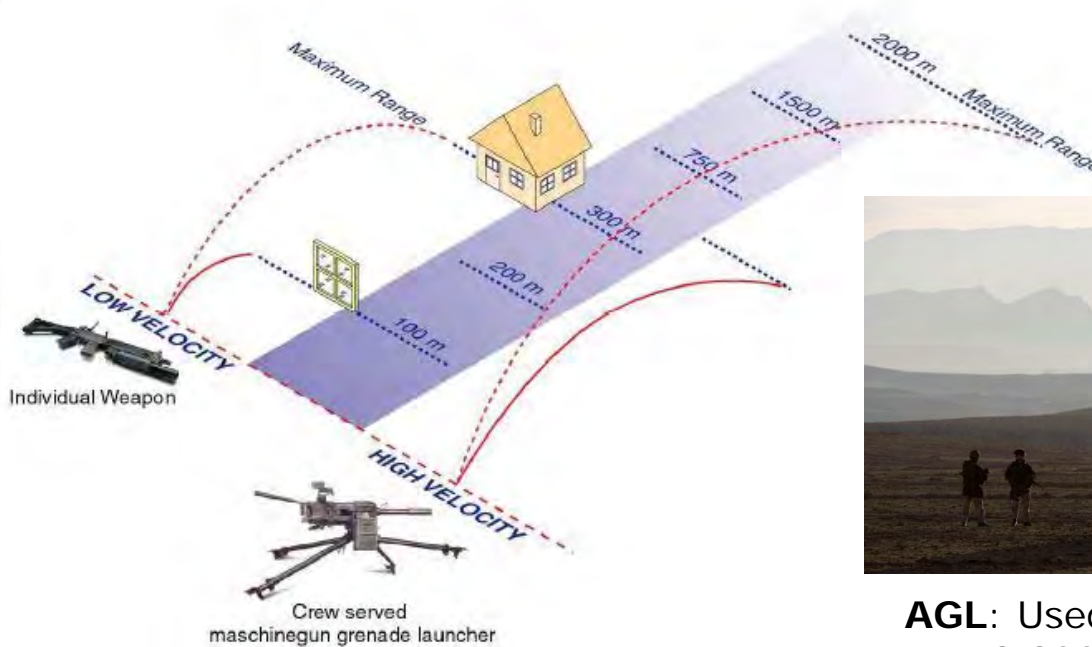
M203



HK 69A1



M79



CIS 40AGL



Mk 19



GMG



LAG 40



**AGL:** Used at firing ranges  
2,200m - 2.500m





# TFU Experiences

## 40mmx46 (Low Velocity Ammunition)

Underslung  
AG36



Stand alone



- ❑ Need for a wide range of different types of rounds; from HE to Less than Lethal (F&B; IR ILL).  
Different colours of smoke (Marking).

High quantity use



# TFU

## Experiences

### 40mmx53 (High Velocity Ammunition)



40mm AGL  
H&K

Used at firing ranges  
2,200m - 2.500m

40mmx53  
HEDP M430

USA support



DIEHL  
40mmx53  
HE-T SD DM111

GER support



High quantity use  
Very effective



# TFU

## Experiences

### Mortar Ammunition



60mm Hotchkiss

✓ 60mm

✓ 81mm



81mm L16A1 / L16A2



# TFU

## Experiences

### 60mm Mortar

#### 60mm Rounds (examples)



HE



SMK  
WP



ILL



Usefull equipment  
(Platoon Level)

Ranges: 400m – 1.000m

**High quantity use**

#### Ammo quality problems:

- ☐ SMK (Low smoke production)
- ☐ ILL (Non functioning)



# TFU

## Experiences

### 81mm Mortar



HE  
with Fuzes PD or Prox



SMK  
WP



SMK  
RP



ILL  
Also IILL IR

High quantity use



New ammo family  
coming up.



# TFU Experiences

## AT/AS Ammunition

- ✓ AT4
- ✓ LAW M72A1
- ✓ PzF
- ✓ Bunkerfaust
- ✓ Gill





# TFU Experiences

## AT4 and LAWM72A1



Special Forces



AT 4



M72A1

Not effective against  
Quala's



# TFU Experiences

## Panzerfaust Family

Heavy System  
(in case of walking)



**PzF DM12A2**



Developed to defeat armour  
with inserted probe: HESH mode

**Scalable effect!**



**BF most effective  
system to defeat  
Quala's**



**BF DM32**



Developed to  
defeat bunkers



# TFU

## Experiences

Gill

High Cost System



**Effective to defeat Quala's**  
Alternative: Apache / Art support  
but that takes more time





# TFU

## Experiences

### "Infantry Support"

### Weaponsystems (≡ Ammunition)



- **155mm PzH2000NL**

- **Apache Helicopter**

- ✓ 30mm HEDP
- ✓ 2,75" Rockets
- ✓ Hellfire Missiles



- **F16 Aircraft**

- ✓ 20mm FAP (now M70 mix)
- ✓ Bombs (Laserguided/GPS)
- ✓ Missiles (Air-to-Air)







# TFU Experiences

## 155mm PzH2000NL ammunition



HE

DM131A1 40km

M107  18km

SMK HC

DM115 >20km

ILL

DM116 >20km

**High quantity use**  
All types

**Propelling charges**

M4

Nr13 (8th charge)

Modullar Charges DM92





## Experiences

### Apache Helicopter

- ✓ 30mm HEDP
- ✓ 2,75" Rockets
- ✓ Hellfire Missiles



30mm HEDP  
M789



Effective Ammunition  
Against Quala's ?



30mm M230



High quantity use  
All types



M231

Hellfire II, AGM-114N,  
for use against buildings, bunkers:

Effective against Quala's ?

High cost system





# TFU

## Experiences

### F16 Aircraft

- ✓ 20mm FAP (now: M70)
- ✓ Bombs
- ✓ Missiles

Laserguided (GBU12)

GPS guided (GBU38)

Laser/GPS (GBU49)



20mm FAP



High cost systems



High quantity use  
All types





# TFU Experiences

## Other Infantry Ammunition

### Handgrenades

#### Smoke



#### Offensive



#### Incendary



#### Smoke Color



#### Fragmentation

**High quantity use**  
All types  
**Extreme Rough Handling**  
(tune up qualification programmes?)



#### F&B



#### Teargas



66mm Launchers on  
MB Special Forces

 **TFU**   
**Experiences**

**Smoke Grenades**

76mm Launchers on  
Fennek



**66mm SMK RP**

Patria  
YPR  
Viking



PzH2000

**76mm Smoke RP**



**No info on High  
quantity use**

Investigation on operational  
functioning in extreme climate  
area's







# TFU Experiences

## IED threat



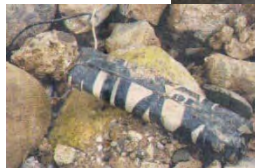
Working Levels



Protection



Mild Traumatic  
Brain Injury (mTBI)



Extremey Dangerous



RKG3



## DATA Loggers



## Pilot Data Collecting

- Shock
- Temperature  
(solar radiation)
- Humidity



120mm Leopard 2



**120mm** Tank Ammunition

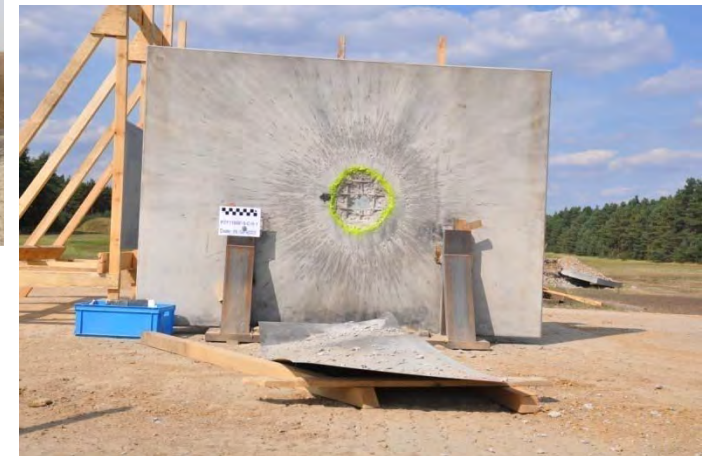
**155mm** Artillery Ammunition



**MOUT Experiment**

**35mm** IFV Ammunition

**AT/AS Panzerfaust Family**



**In planning:**

Gill, Hellfire (?),  
Medium Caliber (25, 30, 35, 40)  
Others?

**International Data Exchange**

GER, TV28

USA, DEA1182

DNK, CH, CAN





HEAT-T



120mm

HE/PD-SQ  
TP-T



PELE



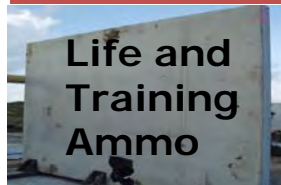
TPCSDS-T



Canister



## MOUT Experiment Ammunition Involved



Life and  
Training  
Ammo



155mm

HE



TP & TP with Spotting Charge

35mm

KETF



TPFDS-T





## MOUT Experiment

AT/AS Ammunition Involved

PzF HEAT DM12A2



BF DM32



**Dynamit Nobel**

Inserted Probe:  
HESH mode



PzF90 HEAT



PzF60 HESH DM62



PzF90 ASM





## Breaching Experiment



Djemaco  
C7/C8



Simon



Underslung AG36

HK 69A1



40mmx46  
Breaching





## New IFV with 35mm ammunition



Studies on 30/35mm:

Life Cycle Cost

Ammunition Effectiveness

Firing Doctrines



HÄGGLUNDS

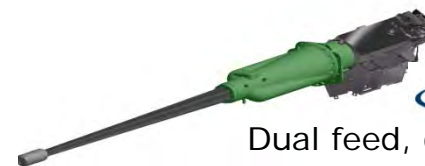
OLD → NEW

YPR 765 with 25mm KBA B02B

ERA protection (TFU)



CV9035NLD with 35mm Bushmaster III



Dual feed, chaingun.  
Linked ammunition





## 35mm Linked Ammunition




> 400 particles



Effectiveness study

Under Development



APDS-T, nr555 

TPFDS-T, nr469 



FAPDS-T, DM33  
Temporary

KETF, nr468 



TP-T, PMD064

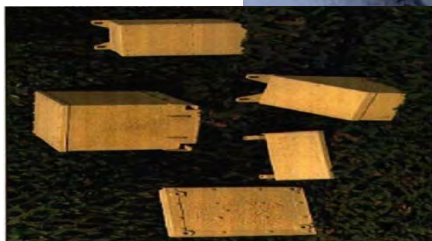
HEI-T, PMD040



APFSDS-T, PMD343



## Additional Protection Programm CV9035NLD



ERA ?



APS ?





Problems



Problems

## Standardisation of Ammunition

**AN ABSOLUTE MUST !**



Working together  
with  
coalition partners

**A CHALLENGE**



Small Caliber Ammo



STANAG 4172  
STANAG 2310  
STANAG 4090



CIS 40AGL



Mk 19



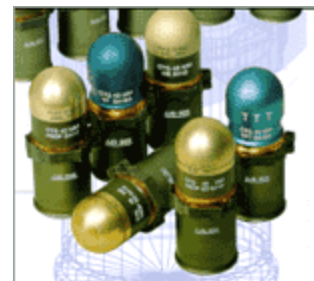
GMG



LAG 40



STANAG 4403



40 x 53mm High Velocity Ammunition

40mmx53



Male - Female



Problems



Problems

## Standardisation of Ammunition

Not Sytem Ready

**AN ABSOLUTE MUST !**

Everything is different



US Ammo in Leo and VV

**120mm Tank Ammunition**



STANAG 4385



**Working together  
with  
coalition partners**

**A CHALLENGE**



M252, L16, etc

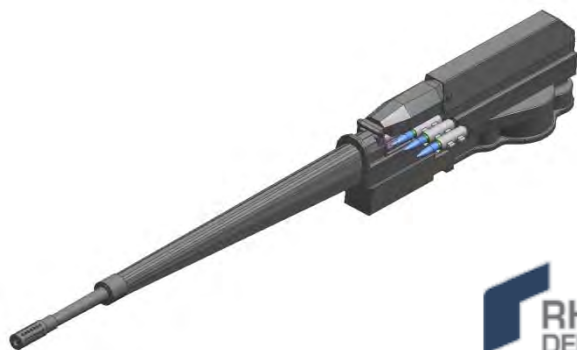
**81mm Mortar Ammunition**



STANAG 2427



## Some Interesting Developments



### Lightweight 12,7mm

External Powered

Dual feed

Linkless Ammunition



STANAG 4383



### 40mmx46 MV

Existing Weapons?



### Lightweight 25mm

External Powered

Dual feed

New Caliber (25mmx59)



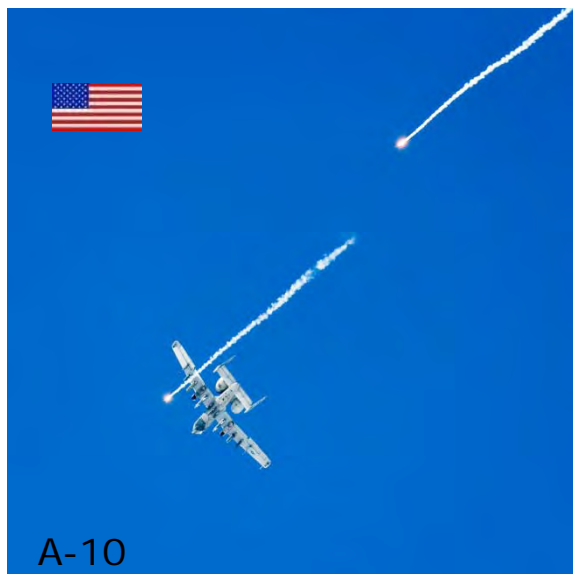
STANAG 4173

## Standardisation vs Modernisation

Warfighter Focussed  
Technology Driven



## Systems In Action



A-10



F-16 NLD

**Peace Keeping Operation  
with  
High Ammunition Use**



PzH2000 NLD





## Sunset in Afghanistan

Some gave all  
for a safer world







## Thank You for your Attention

Hans Hoeneveld  
Program Manager Ammunition

Land Systems Branch  
Weapon Systems & Ammunition Division  
Section Ammunition

Defence Materiel Organisation



Van der Burchlaan 31  
P.O. Box 90822  
2509 LV The Hague, The Netherlands  
Phone +31(0)70 316 35 88  
Mobile +31(0)6 53 43 98 04  
Fax +31(0)70 316 46 03  
jc.hoeneveld@mindef.nl

Major  
**R.G. van Schaik (Ruud)**  
Project Manager Ammunition

Land Systems Branch  
Weaponsystems & Ammunition Division  
Section Ammunition

Defence Materiel Organisation



Van der Burchlaan 31  
P.O. Box 90822  
2509 LV The Hague, The Netherlands  
Phone +31(0)70 316 35 74  
Mobile +31(0)6 53 54 17 66  
Fax +31(0)70 316 46 03  
rg.v.schaik@mindef.nl



# NDIA Joint Armaments Conference

*Technology Development, Transition, and Next Week  
An Industry Perspective*

Jay Tibbets  
Senior Vice President  
Business Development

18 May 2010



*Advocate – Promote – Provide*



- *“This budget provides the resources to sustain a military at war. It takes care of our people, rebalances military capabilities, reforms what and how we buy, and supports our troops in the field.”*
- *“I believe the Department should seek increasing competition, use of prototypes, and ensure technology maturity so that our programs are ready for the next phases of development...”*
- *“We must ensure that requirements are reasonable and technology is adequately mature to allow the department to successfully execute the programs”*
- *“The gusher has been turned off and will stay off for a good period of time...”*
- *“Must provide direct support to current operations and the current force through providing technology solutions and rapid acquisition”*
- *“We’ve seen how relatively low cost, off-the-shelf technology can have a huge impact on the battlefield”*
- *“...99% solution over a period of years, or a 75% solution over a period of weeks or months.”*

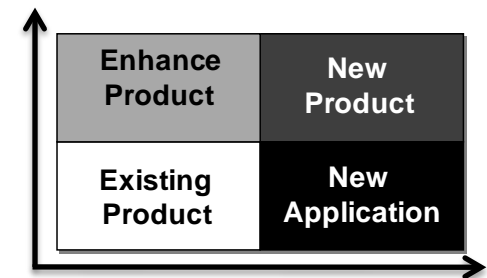


*Must rapidly transition technologies that support current operations!*

- Role and responsibilities – *Voice of the Customer*
  - *Maintain awareness of market trends, forecasts, and policies*
  - *Listen and communicate Customer needs, requirements, and timing*
  - *Identify and develop emerging market opportunities*
  - *Develop business cases for new products and services*
  - *Foster strategic relationships with technology partners*
  - *Prioritize and validate discretionary investment*
  - *Organizational responsiveness to Customer demand*
  - *Promote ATK as a supplier of choice*

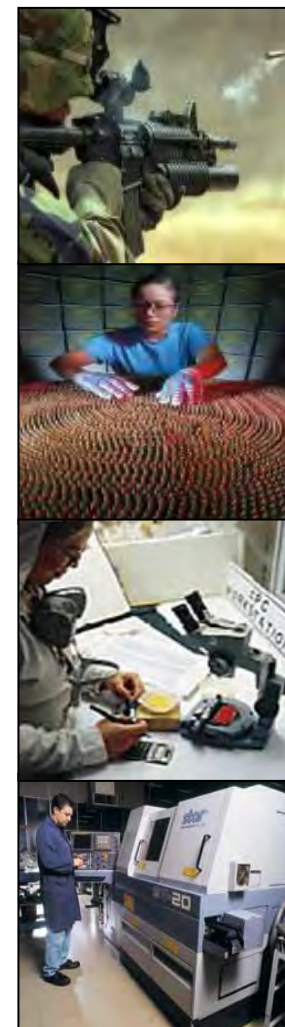


- 
- Discretionary investment – *Business Sponsor*
    - *ATK's commitment to the Customer community*
    - *Integral part of business planning process*
    - *Limited resources so must select projects wisely*
    - *Focus IR&D projects that solve Customer problems*
    - *Business case – investment and return*



*Prioritizing investment to meet demand!*

- Industry must respond with rapid development cycles and more streamlined processes
- No time for science projects, may be fun for scientists but rarely provides meaningful capability to the Warfighter or meaningful revenue to Industry
  - *Industry is willing to invest to provide real capability that satisfies a real need*
- Seek technology partners and leverage existing technology
  - *Scale or adapt to fill capability gaps; do not have to develop*
- Affordable and innovation are match made in heaven; must go hand in hand
- Government spending patterns must reflect both the need to equip Warfighters and sustain industrial capability
  - *Requires sound investment strategies and partnering*
  - *Joint R&D reviews that align capability gaps with potential solutions*
- Technology advances that help preserve a viable industrial base are becoming as important as the technology in the weapons themselves
- Leverage ManTech Program to reduce manufacturing costs and risks
  - *Enables affordable production and transition of new technologies*



*Focused on rapidly fielding mission-critical technology*



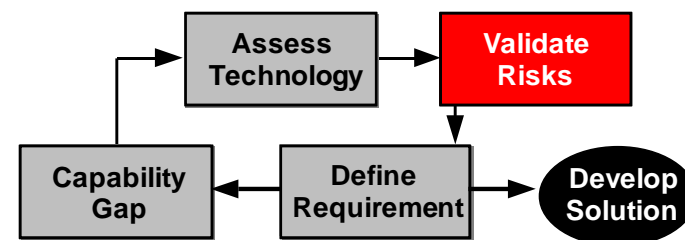
# Closing the Gap – A Few Simple Suggestions



A premier aerospace and defense company

**Risk** – *What is to be achieved measured against what is available*

- Process begins and ends with the User
  - *Needs must be translated to meaningful requirements*
- Evaluate the criteria upon which requirements are based
  - *Validate maturity of technology and producibility*
  - *State of the art vs. state of the possible – real world context*
- Set realistic requirements and expectations so industry can deliver on time and on budget
  - *Industry must communicate reality of delivering desired capability*
- Requirement \$hift, requirement \$hift, requirement \$hift
  - *75% is good enough...get it to the Warfighter!*
  - *Mature it later through spiral development with user input*
- Solidify technical baseline then move to production
- Safety first but streamline test and evaluation protocol to accelerate material release



*Driving through the development cycle*



# Providing the Right Response – *Technology in Action*



A premier aerospace and defense company

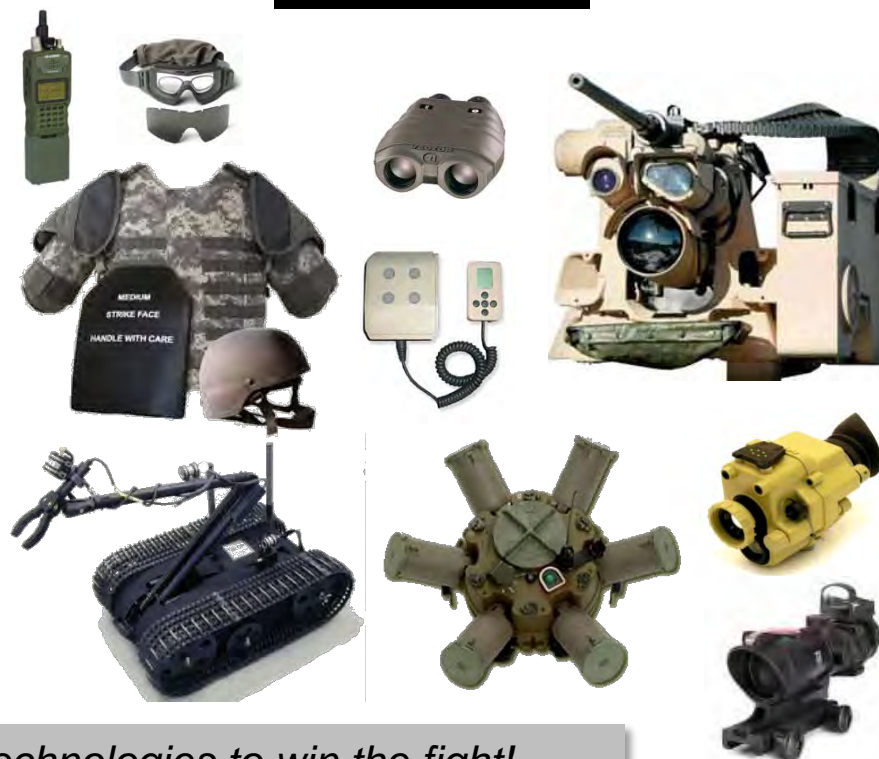
- Warfighters adapt quickly to ever-changing threats and challenges
- Technology permeates almost every aspect of preparing Warfighters for war
- Transformation-enabling technology advances were quickly fielded
- Focus on affordable technology that fills Warfighter's capability gaps



## Lethality



## Survivability



*Accelerating the delivery of technologies to win the fight!*





# Innovation ... Delivered.



[www.atk.com](http://www.atk.com)



# F-35 Weapon System Overview



**Doug Hayward**  
**Deputy Director F-35 Vehicle Systems**  
**Lockheed Martin Aeronautics**







# JSF SDD Program Overview

## Interoperability



## Global Sustainment

## Domestic / International Suppliers



## CV



## CTOL



## STOVL



## P&W F135 GE/RR F136



## 3 Services



## 8 International Partners



## 2 Security Cooperation Participants



## Autonomic Logistics



## 3 Flight Test Facilities



## Integrated Training



## Team JSF

LOCKHEED MARTIN

NORTHROP GRUMMAN

BAE SYSTEMS



GE Rolls - Royce  
Fighter Engine Team

Mar 40 2





# *F-35 5<sup>th</sup> Gen Multi-Role Fighter*



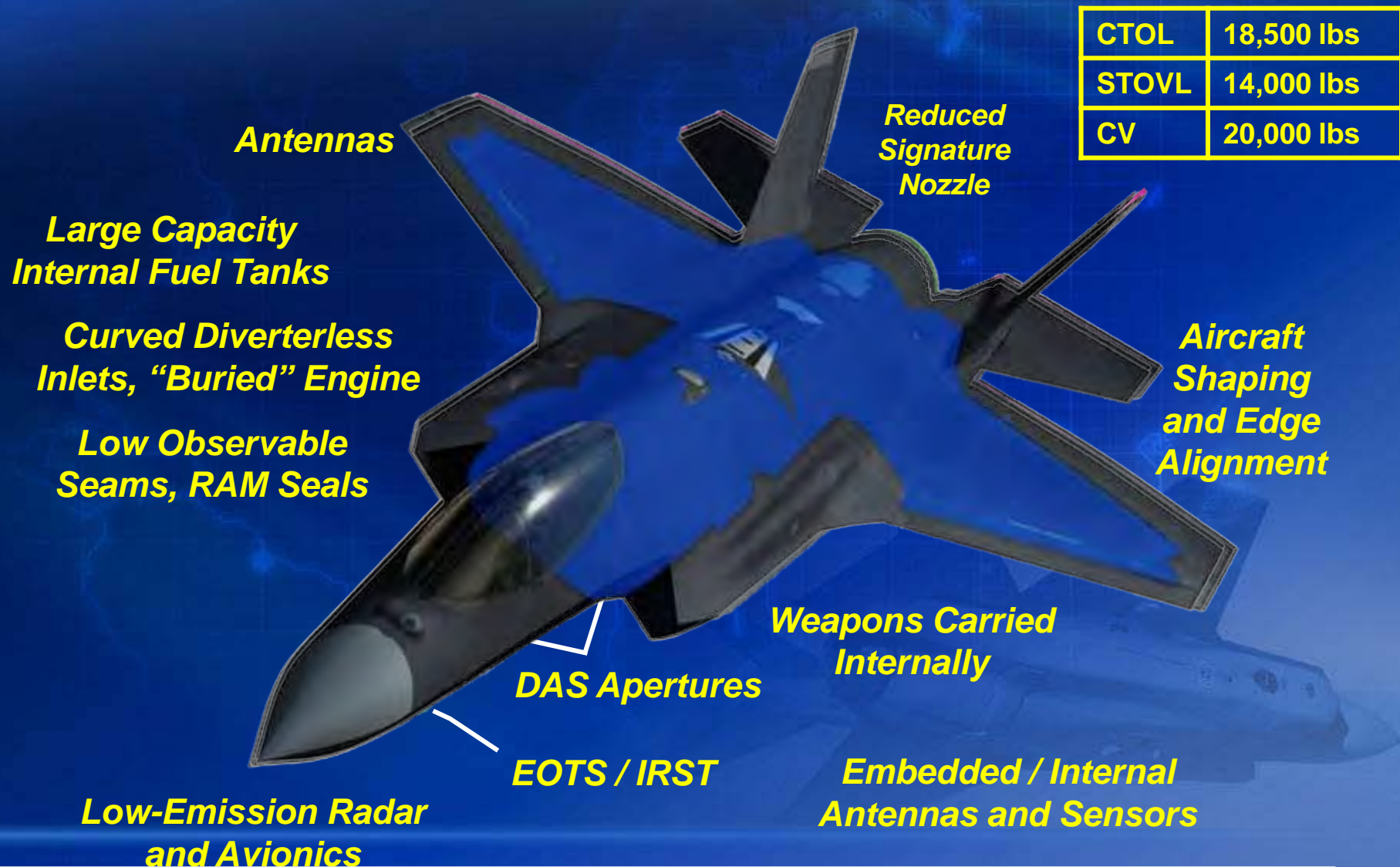
- Stealthy, Supersonic, Multirole, STOVL
- Joint and Coalition Interoperability
- F-16 / F/A-18 Speeds and Performance
- Advanced Avionics and Data Links
- Advanced Countermeasures
- Increased Endurance / Range With Internal Fuel and Weapons
- Smaller Logistic Footprint...Requiring Less Support and Airlift



***Lethal   Survivable   Supportable   Affordable***



# VLO Stealth Must Be Designed-In



**Fundamental 5TH Gen Design Features Can Not Be Retrofitted**





# The Solution – A Quantum Leap In Capability



Capability

**5<sup>th</sup> Generation  
Fighters  
(Circa 2005 )**

Net-Enabled Ops

Integrated Sensor Fusion

Advanced Stealth With  
Fighter Performance



**4<sup>th</sup> Generation  
Fighters  
(Circa 1975 )**

Multi-Mode Sensors

Precision Weapons

Energy Maneuverability



Time

***F-35 Is the Future***



# Lockheed Martin Multi-Service Design

## Carrier Variant (CV)

Probe and Drogue Refueling (Basket)

Strengthened Landing Gear and Tailhook

Wingfold and Ailerons Added

Probe and Drogue Refueling (Basket)

Lift Fan

Roll Posts

Centerline Gun Pod with 25mm Gun

Larger Wing and Horizontal Tail Area

## Conventional Take-Off and Landing (CTOL)

In-Flight Refueling Door (Boom)

Internal 25mm 4-Barrel Gattling Gun

3-Bearing Swivel Nozzle

## Short Take-Off and Vertical Landing (STOVL)





# CTOL Comparison (USAF)



**F-16**

<b>Length</b>	<b>49.7 ft</b>
<b>Span</b>	<b>31 ft</b>
<b>Wing Area</b>	<b>300.2 ft<sup>2</sup></b>
<b>Internal Fuel</b>	<b>7,162 lb</b>



**F-35 CTOL**

<b>Length</b>	<b>51.4 ft</b>
<b>Span</b>	<b>35 ft</b>
<b>Wing Area</b>	<b>460 ft<sup>2</sup></b>
<b>Internal Fuel</b>	<b>18,483 lb</b>



**F-22**

<b>Length</b>	<b>62.1 ft</b>
<b>Span</b>	<b>44.5 ft</b>
<b>Wing Area</b>	<b>840 ft<sup>2</sup></b>
<b>Internal Fuel</b>	<b>18,448 lb</b>

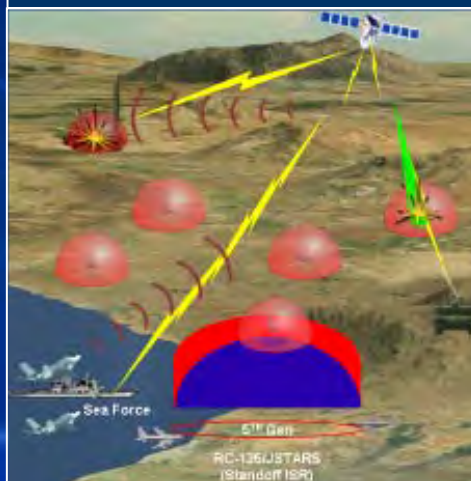




# Multi-Mission Capability



- **Very Low Observable Stealth**
- **Fighter Performance**
- **Integrated Sensor Fusion**
- **Net-Enabled Operations**
- **Peace Keeping Capabilities**
- **Advanced Sustainment**



**F-35 Redefines Multi-Role Aircraft**

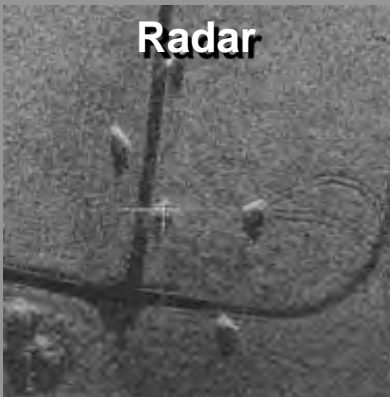




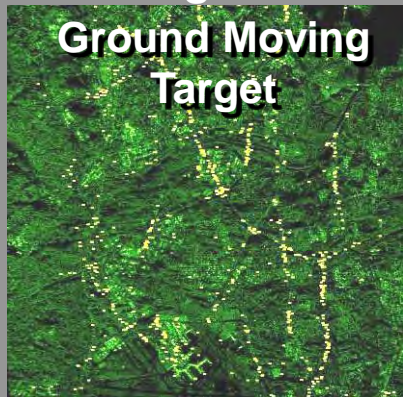
# Total Situational Awareness

*Data Links / Interrogators / EW Suite ... Multi-Spectral Sensors*

**Radar**



**Ground Moving Target**



**Electro-Optical**



**Missile Warning**



**Fused Tactical Information Managed & Displayed To The Pilot**





# A Quantum Leap in Capability

## Air-to-Air



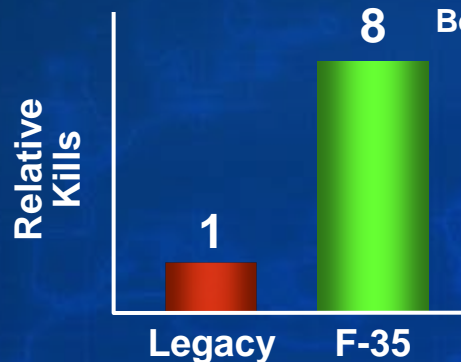
Better



## Air-to-Ground



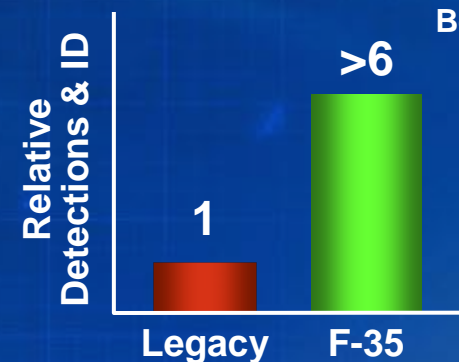
Better



## ISR



Better



## Acquisition Cost



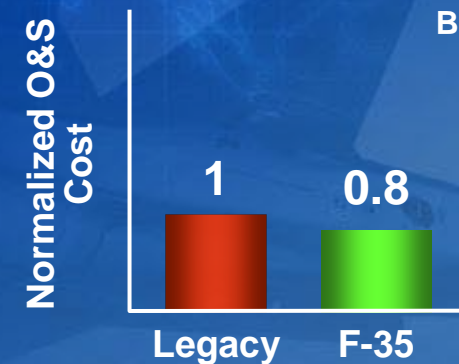
Better



## O&S Cost



Better



**Unprecedented Effectiveness...and Value**

# F-35 Weapon Carriage Overview



**“Putting the Strike in the Lightning II”**





# Weapons Carriage Requirements



CTOL Internal Gun

Store Fully Certified During SDD

## EXTERNAL WEAPONS

## INTERNAL

## EXTERNAL WEAPONS

426 -Gallon Wing Tank

Stormshadow

AGM-158 JASSM

MXU-648/CNU-88 Baggage Pod

AGM-154A/C JSOW Glide Bomb

AIM-120B/C AMRAAM

GBU-31 JDAM 2,000-lb  
(MK-84 Warhead)

AIM-9X Sidewinder

GBU-32 JDAM 1,000-lb  
(MK-83/BLU-110 Warhead)

BDU-57/58/60  
Laser-Guided Training Round

GBU-31 JDAM 2,000-lb  
(BLU-109 Warhead)

Missionized Gun

Brimstone/Joint  
Common Missile

MK-76/MK-58/BDU-48

GBU-32 JDAM 1,000-lb  
(MK-83/BLU-110 Warhead)

GBU-12 Paveway II 500-lb LGB  
(MK-82 Warhead)

GBU-31 JDAM 2,000-lb  
(MK-84 Warhead)

AGM-154A/C JSOW Glide Bomb

GBU-38 JDAM 500-lb  
(MK-82 Warhead)

Brimstone/Joint  
Common Missile

AIM-120C AMRAAM

GBU-31 JDAM 2,000-lb  
(BLU-109 Warhead)

AIM-132 ASRAAM

## Weapons Currently Under Development

UK 500# PGB

Phase I SDB

GBU-10 Paveway II 2,000-lb LGB (MK-84 Warhead)

GBU-24A/B Paveway III 2,000-lb LGB (MK-84 / BLU-109 Warhead)

GBU-16 Paveway II 1,000-lb LGB (MK-83 Warhead)

MK-83 BLU-110 LDGP 1,000-lb LDGP

MK-83 BSU-85 HDGP

MK-84 2,000-lb LD/HDGP

MK-84 BSU-50 Ballute 2,000-lb HDGP

GBU-12 Paveway II 500-lb LGB  
(MK-82 Warhead)

MK-82 500-lb LD & HD

CBU-99/100 Rockeye II  
Cluster Munition

AIM-132 ASRAAM

Nov 09-12

Public Release JSF Public Release

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

© 2009 Lockheed Martin Aeronautics Company





# Weapon Integration Overview

## Internal Weapon Bays

- Combined A-G and A-A

### Weapon Bay Integration

- 1000 lb on STOVL
- Internal Adapters

## SMS Hardware I/O Structure (No OFP)

### Armament Carriage Systems

Stores

### Weapon Supplier and Data Management

Stability

Single Point  
Safing From  
Outside  
Cockpit

MIL-  
Inter  
Stati

### Stores Management Systems

- T
- 8 Independent '1553 Channels

### GAU-22/A 25mm Gun

- Internal (CTOL)
- Missionized (STOVL/CV)

Cer

### Stores Certification Process Management

### 6 External Hardpoints Fwd of MLG

Air-to-Air and Air-to-Ground Pylons  
Advanced Rail Launchers and AME

### All Versions

OVL) Mil-STD-1760 Class 1  
& CV)



# F-35 Weapons Stations



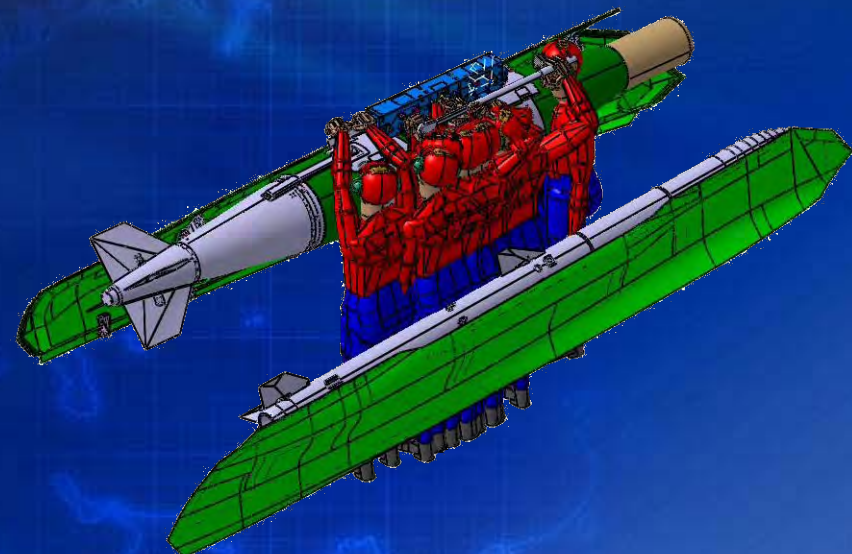
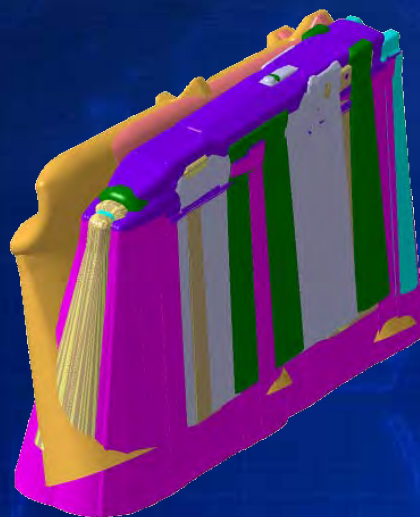
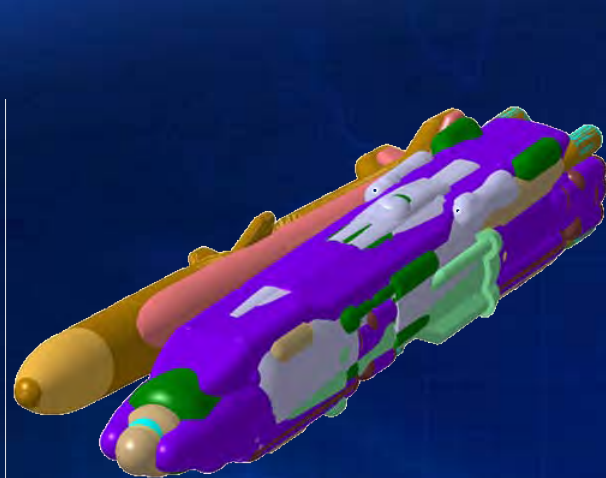
Station	11	10	9	8	7	6	5	4	3	2	1
Store	A/A	A/A, A/S	A/A, A/S	A/A, A/S	A/A	Gun	A/A	A/A, A/S	A/A, A/S	A/A, A/S	A/A
Capacity CTOL/CV	300	2,500	5,000	2,500	350	1,000	350	2,500	5,000	2,500	300
Capacity STOVL	300	1,500	5,000	1,500	350	1,000	350	1,500	5,000	1,500	300

**Over 18K lbs Of Payload Capability**

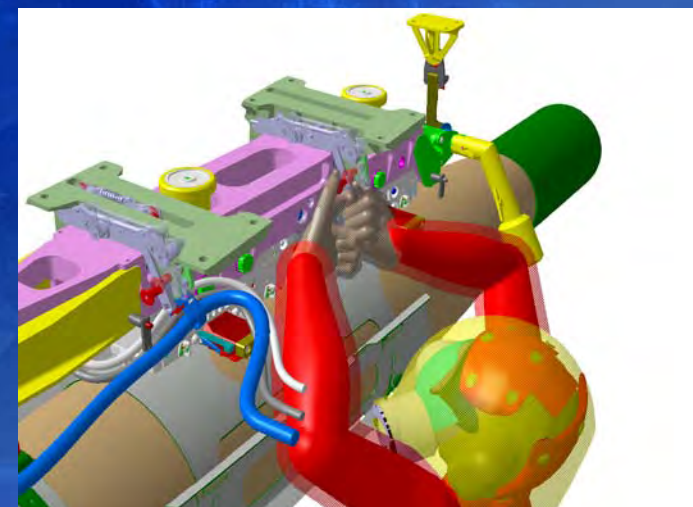




# Weapon Bay Stay-Out Volumes Definition



- **Weapon Stay-Out Volumes Defined to Protect Internal Bay Volume**
  - Includes All Required Weapons Plus Static, Fall and Maintainer Access Clearances
- **Incorporates Internal Bay Design Lessons Learned**
  - Additional Clearance for Access and Flow-Field Effects





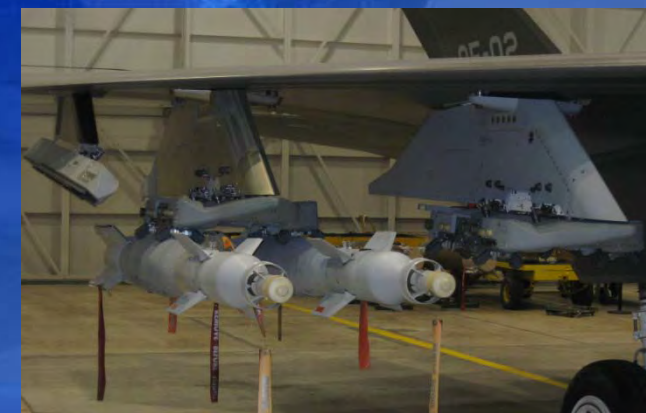
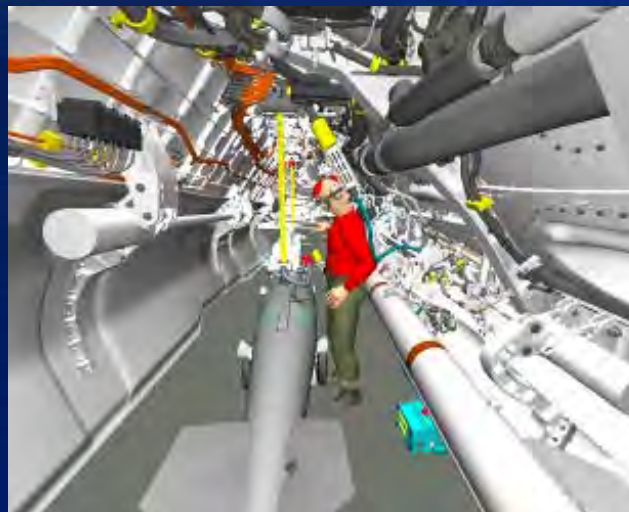


# Weapon Loading Validation

## Real Time Motion Capture

## Real-Time Immersive Simulation

## Aircraft Load



**Ship – Air Integration Lab Utilized To Substantiate Loading Prior to First Load**





# F-35 Gun System Development



- **General Dynamics GAU-22/A Gun System**
  - 3,000 SPM Four Barrel Derivative of GAU-12
  - Currently Qualified with PGU-20/U API and PGU-23 TP Ammunition
- **Primary Mission A/G with A/A Fallout Capability**
- **Internal Installation for CTOL**
  - 181 Rounds Linear Linkless Feed System
  - Over 50,000 Rounds Fired in Development and Qualification
  - Qualification Completed in 2008
- **Missionized Pod for STOVL and CV**
  - 220 Rounds Helical Feed System
  - Currently in 36,000 Round Qualification Test Program





# JSF Capability Upgrades Through Spiral Block Plan



## **Block 0.1 – First Flight and Envelope Expansion**

*Basic functions to get the Aircraft Flying*

Supports 7  
Flight  
Performance  
Aircraft

Initial MS Tactical  
Sensors Integration  
“Avionics FF(A3)”  
Initial Weapons  
Testing

Bulk of MS  
Hardware on  
Board

Primarily Software  
Updates with Added  
Weapons

## **Block 0.5 – Initial MS Architecture & Sensor Infrastructure**

*Mission systems infrastructure Build supporting sensor and architecture development*

## **Block 1 – Initial Warfighting Capability**

*Support for the AI mission (limited target set) allowing meaningful operational test*

## **Block 2 – Multi-Mission Support**

*Added support for CAS with expanded target set (sensor detection and weapon prosecution)*

## **Block 3 – Enhanced Warfighting**

*Follow-on build to incorporate advanced decision aids, threshold weapons, and limited objective functionality*

*Spiral Development Process*



# F-35 - Designed for Future Weapon Growth



- Internal Weapon Bay Design Provides Physical Volume for Future Weapons
  - *Future Weapon Designs Should Use F-35 as Design Driver!*
- External Station Spacing and Capacity Sized for Larger External Stores
- All S&RE and AME Designed for MIL-STD-8591 Mechanical Interfaces
- MIL-STD-1760 Class 1 Interface Provided at All Store Stations
- Modular Software Architecture to Minimize Integration Impacts





# Program Schedule





# *The Moving Line*



***LRIP Aircraft Now on Moving Line***



## ***In Ground Testing***



***BF-3 During Structural Coupling Test - Aug. 13 – 17, 2009***





# *In Flight Testing*









# *In Flight Testing*



## *STOVL at USN Test Facility*



# GENERAL DYNAMICS

Armament and Technical Products



## ***F-35 Lightning II Missionized Gun System Status***

***Presented by:***

***Douglas Parker***

***Design/Test Engineer – Joint Strike Fighter Gun System***

***General Dynamics Armament and Technical Products***

***Burlington, Vermont USA***

***802-657-6379***

***dparker@gdatp.com***



# Presentation Outline

- System Overview
- Program Status
  - Qualification Efforts
  - SDD Delivery Status
  - Support Equipment Design
- Path Forward



# JSF Multi-Service Design



CTOL



Span (ft)	35
Length (ft)	50.5
Wing Area (ft <sup>2</sup> )	460



Gun Fairing

F-16

Equipped with internal  
gun system

STOVL



Span (ft)	35
Length (ft)	50.5
Wing Area (ft <sup>2</sup> )	460



AV-8B

Equipped with Missionized Gun System

CV



Span (ft)	43
Length (ft)	50.8
Wing Area (ft <sup>2</sup> )	620



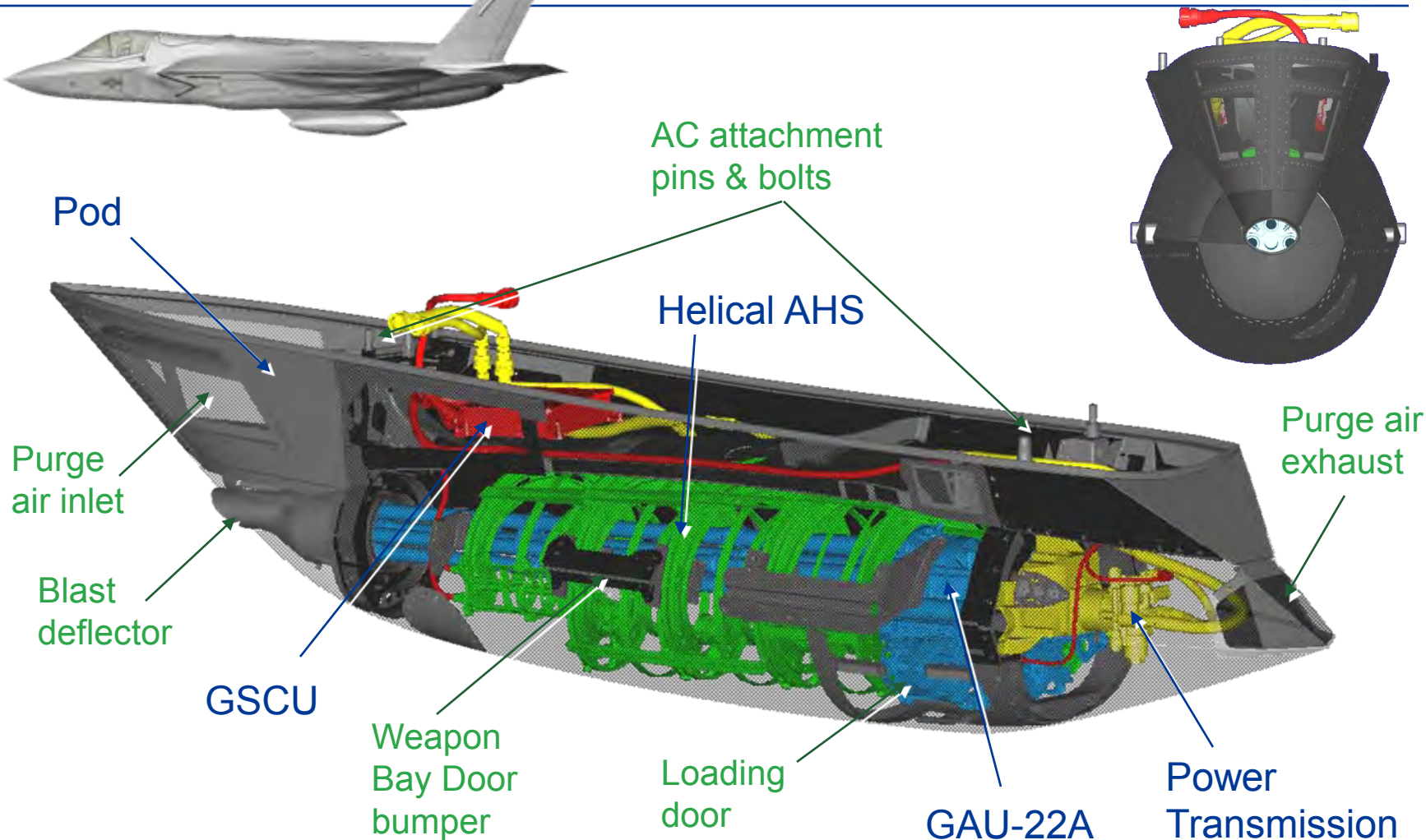
F/A-18C

# Missionized Gun System (MGS) Key Features



- 5 primary assemblies
  - Pod – composite monocoque structure designed and fabricated by Terma of Denmark
  - Gun System Control Unit (GSCU) supplied by Hamilton Sundstrand and software that controls system function
  - AHS - 220-rnd helical linear linkless ammunition handling system.
  - Hydraulic system - 4000-psi system composed of hydraulic lines/hoses, priority valve, and drive (dual sourced to Parker and Triumph)
  - GAU-22A Gatling gun - 3000 spm, 25-mm, 4-barrel, reverse clearing, GAU-12U derivative
- Dispersion - 5 milliradians diameter, 80 percent circle
- 1017 lb fully loaded
- 27" wide, 32" high, 146" long

# MGS Key Components



# Upcoming Program Milestones



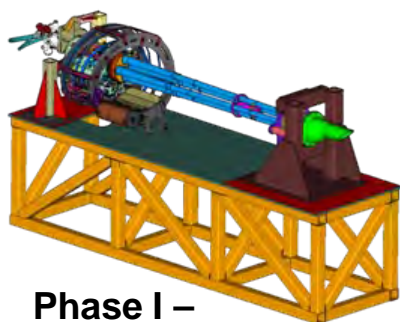
- Qualification complete - June 2010
- Deliver System Development & Demonstration (SDD) systems 2 & 3 – May & July 2010 respectively
- Execute Low Rate Initial Production (LRIP) contracts
  - Two – 3 STOVL systems, August 2011
  - Three – 4 STOVL systems, December 2011
  - Four - 7 STOVL & 2 CV systems, June 2012
- Support equipment
  - Qualification – June to August 2010
  - Deliver – August 2010



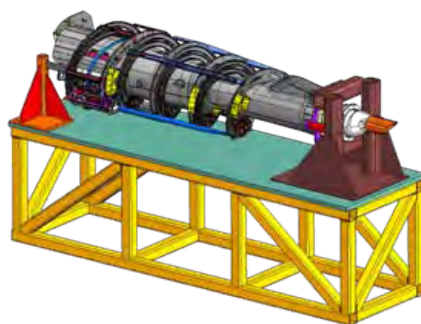
# Engineering Test



- Engineering testing was completed May 2009
  - Three phases shown below
  - 13,503 rounds fired, 1,575 rounds cycled
  - Successful system integration



**Phase I –  
gun only**



**Phase II –  
gun system**



**Phase III - MGS**





# Engineering Test - Video

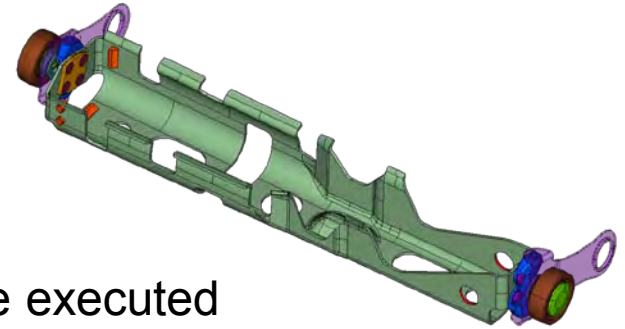


# Engineering Testing – Resulting Design Improvements



- Carrier Durability

- Premature failure of the carrier was caused by high loads experienced at the gun handoff area.
- A rigorous design and evaluation phase were executed
  - FEM, bench top, and system testing at ambient and extreme cold.
- No issues have arisen during qualification testing.



- Hydraulic Fluid Temperature

- The system is designed to meet performance requirements with warm hydraulic fluid.
- System level cold tests highlighted a sensitivity to continuous purge air flow.
- Insulation was added to the fixed and flexible supply lines to mitigate the fluid heat loss.



# Ground Vibration Test

- MGS was installed on aircraft 2BF:003 at LM Aero for ground vibration testing in July 2009
- The MGS fit perfectly and no issues with the gun system were identified!



# Qualification Test Status

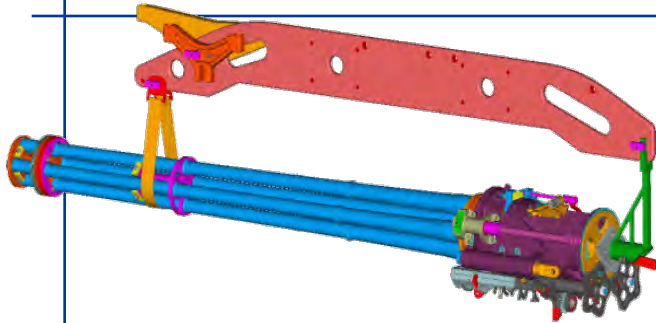


- Testing began with the foundation of fully qualified sub-system components (GSCU, hydraulic drives, and sensors)
  - Pod structure underwent a series of risk reduction tests, including limit load tests and a 36,000 round equivalent gun fire vibration test.
- Specialty tests include
  - High/low delta pressure
  - Hot and cold testing
  - 220-rnd fire out
  - Interrupted bursts
  - Gun gas measurement

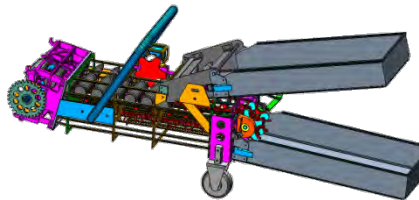




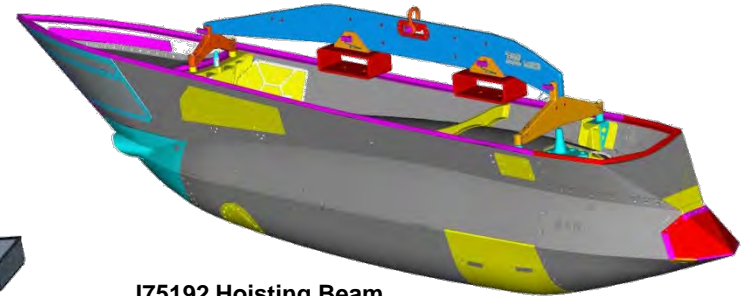
# Support Equipment Design



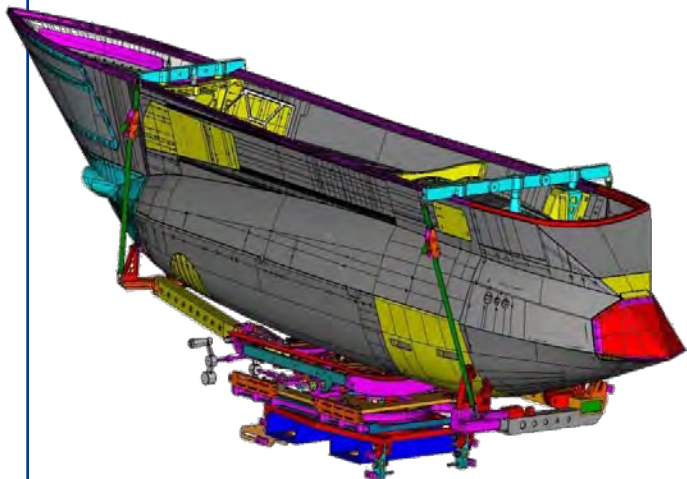
J75199 Gun Transfer Adapter



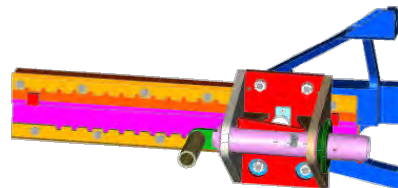
J75208 Ammunition Loader



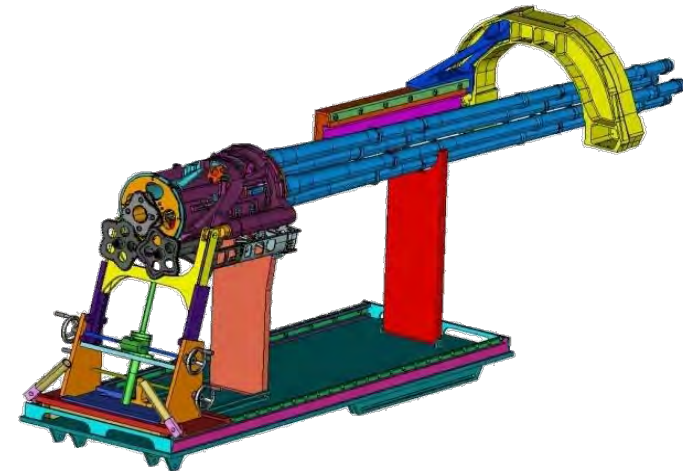
J75192 Hoisting Beam



J75189 Ground Handling Adapter



J75196 Mount Rail



J75197 Gun Mount Adapter



# Key Program Successes



- Leveraged Content

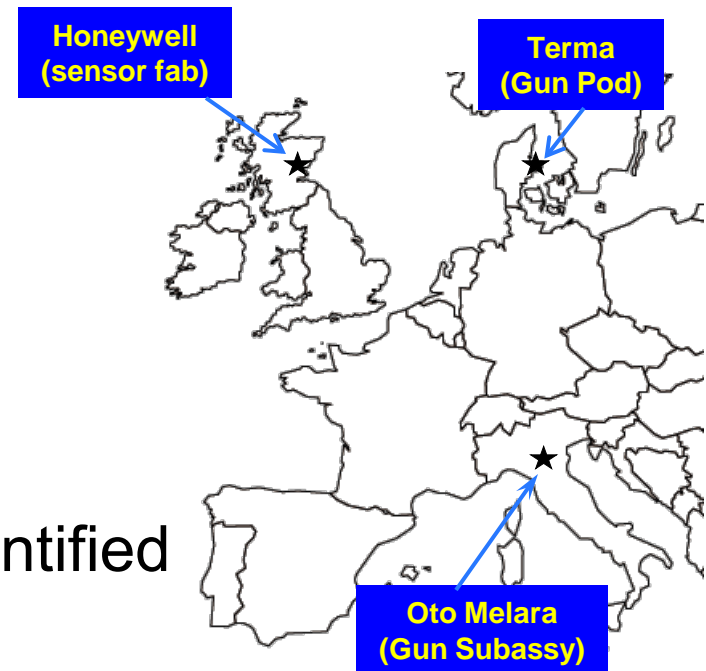
- Numerous efficiencies have been realized by heavily leveraging CTOL components, experiences, and infrastructure.

- Gun is 85% common
    - GSCU is identical
    - Hydrives are identical
    - Sensors are identical
    - Support assets and experience

- Demonstrated system reliability

- Significant international content

- AC fit up with no MGS issues identified



# MGS Path Forward



- Complete MGS qualification
- Deliver non-firing MGS for weapons loader training to LM Aero
- Deliver SDD MGS 2 and 3 to LM Aero
- Negotiate future and execute awarded LRIP contracts



# GENERAL DYNAMICS



**GENERAL DYNAMICS**  
Armament and Technical Products



# EFV Gun and Ammunition Acquisition Strategy Update



Major Ian McDuffie  
Head of Guns and Ammo  
Expeditionary Fighting Vehicle Program





# EFV Demo May 2009







# Agenda

- PM AAA Program Status
- Recent and Future Activities
- Gun and Ammunition Priorities
- PABM Update





# PM AAA Program Status



## A couple quotes from our Commandant...

**“Just like the Osprey, I believe that the Expeditionary Fighting Vehicle is going to revolutionize the battlefield. The EFV has a whole host of critics, who simply do not understand its importance. The United States Marine Corps, the Navy and, arguably, Army paratroop units represent the nation’s forcible-entry capability. The EFV is inextricably linked to that capability and an absolutely critical requirement for us.”**

**“Our Corps’ position remains unequivocal: The Expeditionary Fighting Vehicle is essential to what we do and is our top acquisition priority”**

**-James T. Conway, 34<sup>th</sup> Commandant of the Marine Corps**



**Gen Conway on the EFV assembly line in Lima, OH.**



# Recent EFV Program Activity



- 2<sup>nd</sup> Generation Development Demonstration (SDD-2) vehicle official roll out (4 May)
- These 7 new prototypes will be evaluated during the upcoming Operational Assessment (OA) scheduled for summer 2011.
- The SDD-2 vehicles represent more than 400 design and engineering changes and are expected to be on a predicted reliability growth path of more than 20 hours MTBOMF.



LtGen Flynn Speaking at the SDD-2 Roll Out Ceremony



# Recent and Future Gun and Ammo Activity



- **Recent Activity (last 6 months)**
  - Continued sponsorship of MK310 PABM qualification (successful component demonstration on 23 April validated Naval qualification will begin on 19 May)
  - MK317 TPDS-T Cataloguing
- **Near term acquisition goals (<6 months)**
  - MOA with NSWC Crane establishing them as EFV's MK44 TDA/ISEA and Acquisition Engineering Agent
  - MOA with PM Ammo and NSWC Dahlgren codifying the transition of 30mmX173 ammunition procurement
  - Established a TPDS requirement in the USMC TMR which in turn could enable a domestic TPDS qualification
  - Evaluation of assorted 30mmX173 ammo (to include PABM) against Urban "Qualas" targets (June 2010 Germany)
  - EFV hosts co-located Gun and Ammo IPT and NATO ToE Meetings In Washington D.C. (October 2010)
- **Long term acquisition goals (>6 months)**
  - PABM FTQ (Spring 2011)
  - MK44 LRIP Procurement Contract awarded via NSWC Crane (October 2012)





# EFV's Top Gun and Ammo Acquisition Priorities



- 1. Final Type Qualification of the MK310 PABM
- 2. MK46 PABM Turret Integration
- 3. MK44 LRIP Contracting and Procurement







# PABM Fielding: Priority #1

## Why PABM?



PABM round set on airburst detonating above an infantry target array.

- Per CASFOREM 1997 “PABM is the most effective means for the EFV to move from its threshold to objective lethality requirement”.
- Lethality increase over HE
- Target Set Overlap
- Decreased Life Cycle Costs
- Increased Turret MTBOMF
- Better addresses threats of today’s IW environment



# Ammo Opportunity vs Target Set



**Infantry**



**Lt. Fort. Pos/  
Material**



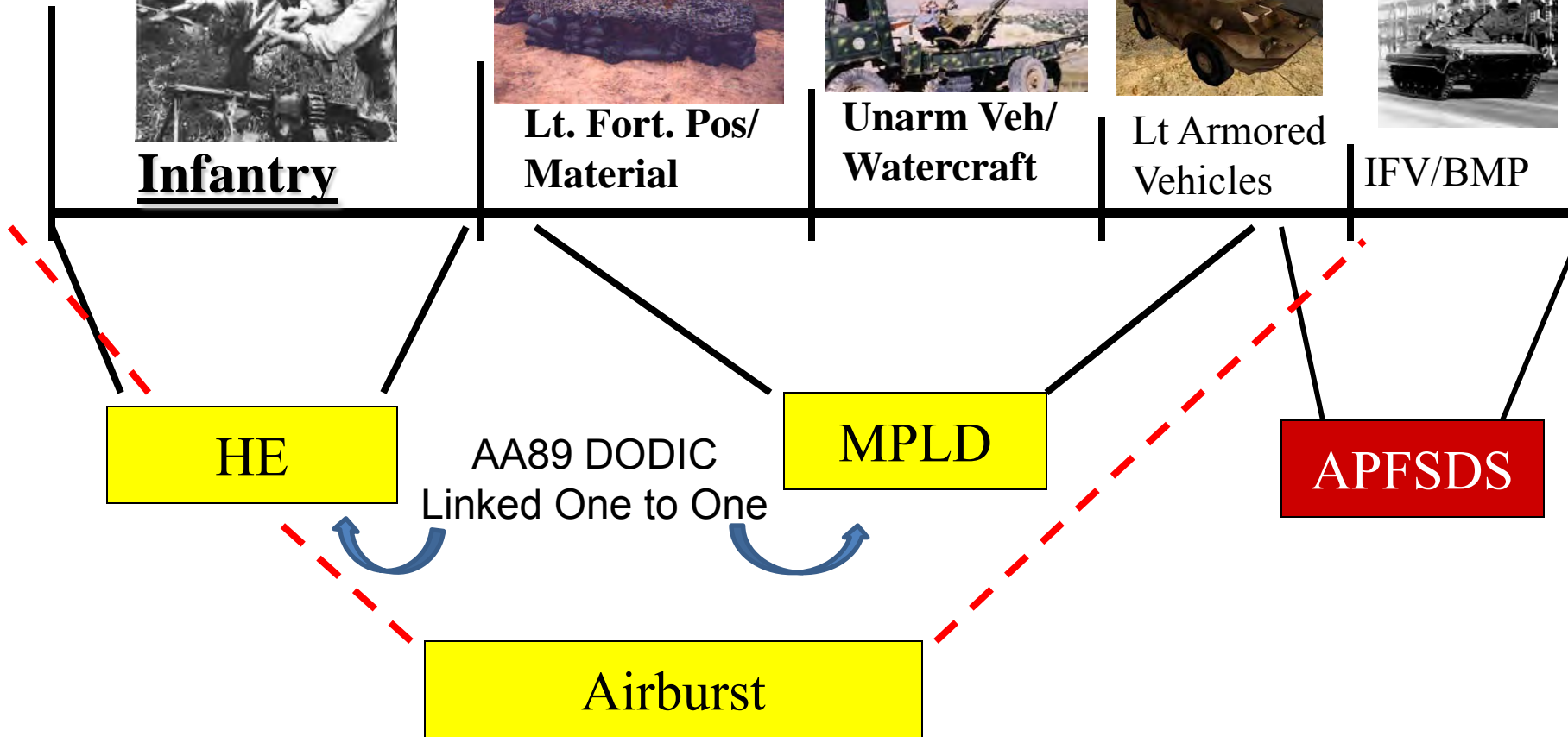
**Unarm Veh/  
Watercraft**



**Lt Armored  
Vehicles**



**IFV/BMP**





# PABM Road Ahead

## PABM Fielding: Priority #1.



PABM round set on delay, penetrating and detonating inside a common urban target.

- Begin Government Qual (May 2010)
- MOUT Trials/Qualas [Demonstration](#) (June 2010)
- WSESRB Review (Nov 2010)
- Final Type Qualification (May 2011)
- Seek POM-14 Funding for MK46 PABM Integration (FY'12)



# 2010 MOUT Trials

A good demonstration of 30mmX173  
Ammunition against “Qualas” Targets



# TFU Experiences

## MOUT Targets

### Quala's



Clay Walls (av. 80cm thick); Sundried, mixed with stones and other materials



# TFU

## Experiences

### 25mm Ammunition (IFV)



1 rnd  
No penetration



3 rnds  
Penetration

25mm APFSDS-T

**NOT very effective** against Quala targets  
**Effective at ranges > 2.000m** (other type of targets)



# TFU Experiences

## AT4 and LAWM72A1



Special Forces



**AT 4**



**M72A1**

**Not effective against  
Qalala's**



# TFU Experiences

**Gill**

High Cost System



**Very effective to defeat Quala's**

Alternative: Apache / Art support

but that takes more time





**120mm** Tank Ammunition

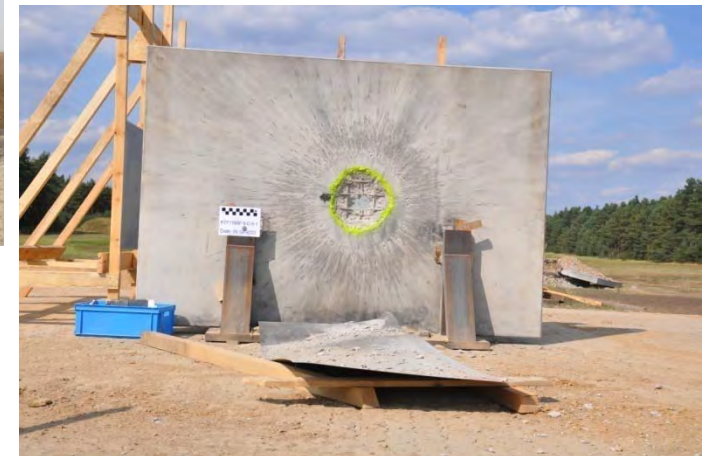
**155mm** Artillery Ammunition



**MOUT Experiment**

**35mm** IFV Ammunition

AT/AS **Panzerfaust** Family




**In planning:**

Gill, Hellfire (?),  
Medium Caliber (25, 30, 35, 40)  
Others?

**International Data Exchange**

GER, TV28 

USA, DEA1182 

DNK, CH, CAN   





# PABM Road Ahead

## PABM Fielding: Priority #1.



PABM round set on delay, penetrating and detonating inside a common urban target.

- Begin Government Qual (May 2010)
- MOUT Trials/Qualas [Demonstration](#) (June 2010)
- WSESRB Review (Nov 2010)
- Final Type Qualification (May 2011)
- Seek POM-14 Funding for MK46 PABM Integration (FY'12)





# Questions?



# ***Expeditionary Fighting Vehicle (EFV) 30mm Ammunition Feed System***



***Presented by:***

***Kim Perkins***

***Project Engineer - EFV***

***General Dynamics Armament & Technical Products***

***Burlington, Vermont USA***

***802-657-6315***

***kperkins@gdatp.com***



# Presentation Outline

- Vehicle Highlights
- Ammunition Feed System (AFS) Overview
- Testing Completed to Date
- Key Program Milestones (and Video)
- Path Forward



# EFV Vehicle Highlights

- **Mission**

- Transport Infantry From Ships Beyond the Horizon to Inland Objectives
- Provide Direct Fire Support During Combat Operations

- **Speed**

- Land: 45 mph
- Water : 29 mph

- **Weight: 76,000 lbs**

- **Carrying Capacity: 20**

- 3 Crew; VC, gunner and driver
- 17 Infantry

- **Fire Power**

- MK46 30mm Weapon Station With the MK44 30mm Automatic Gun
- M240 7.62mm Coaxial Machine Gun







# EFV AFS Key Requirements

- **Ready ammunition capacity:**

Container	Threshold	Objective
Primary (HE)	150	180
Secondary (AP)	50	60
<b>TOTAL</b>	<b>200</b>	<b>240</b>

- **Rate of Fire: 200 rounds/min.**

- ↗ Single shot, 5 round & continuous burst

- **Gun Elevation Range: -10° to +45°**

- **Vehicle Attitude: Up to 60% grade (31°)**

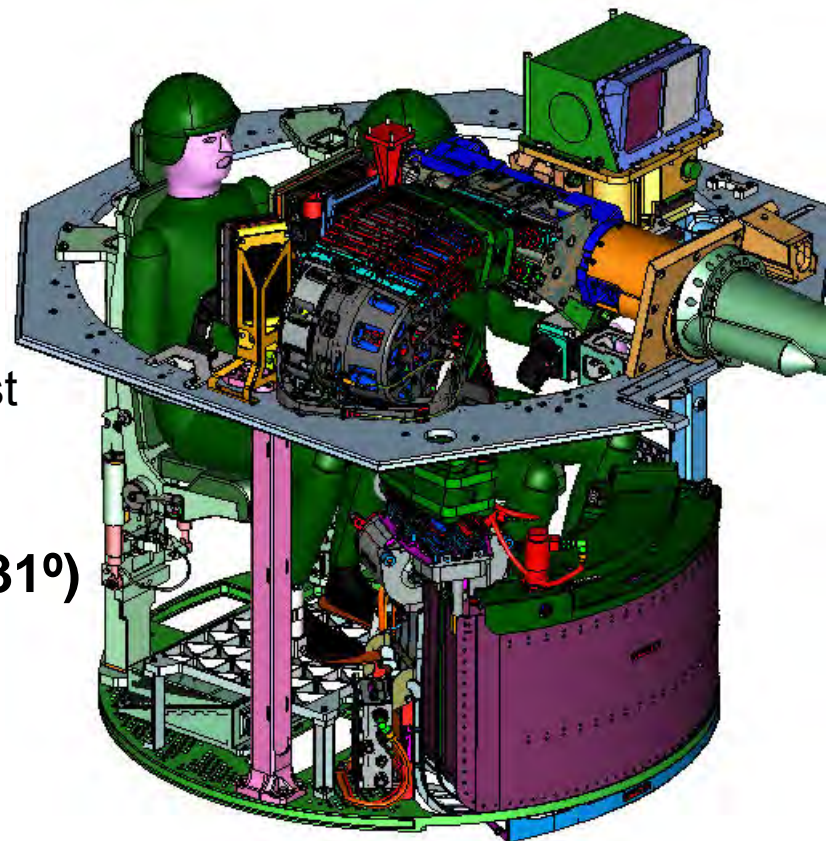
- **Operational after 360° rollover**

- **Weight: 235 lbs**

- **Reliability:**

- ↗  $\geq 10,000$  (MRBF),

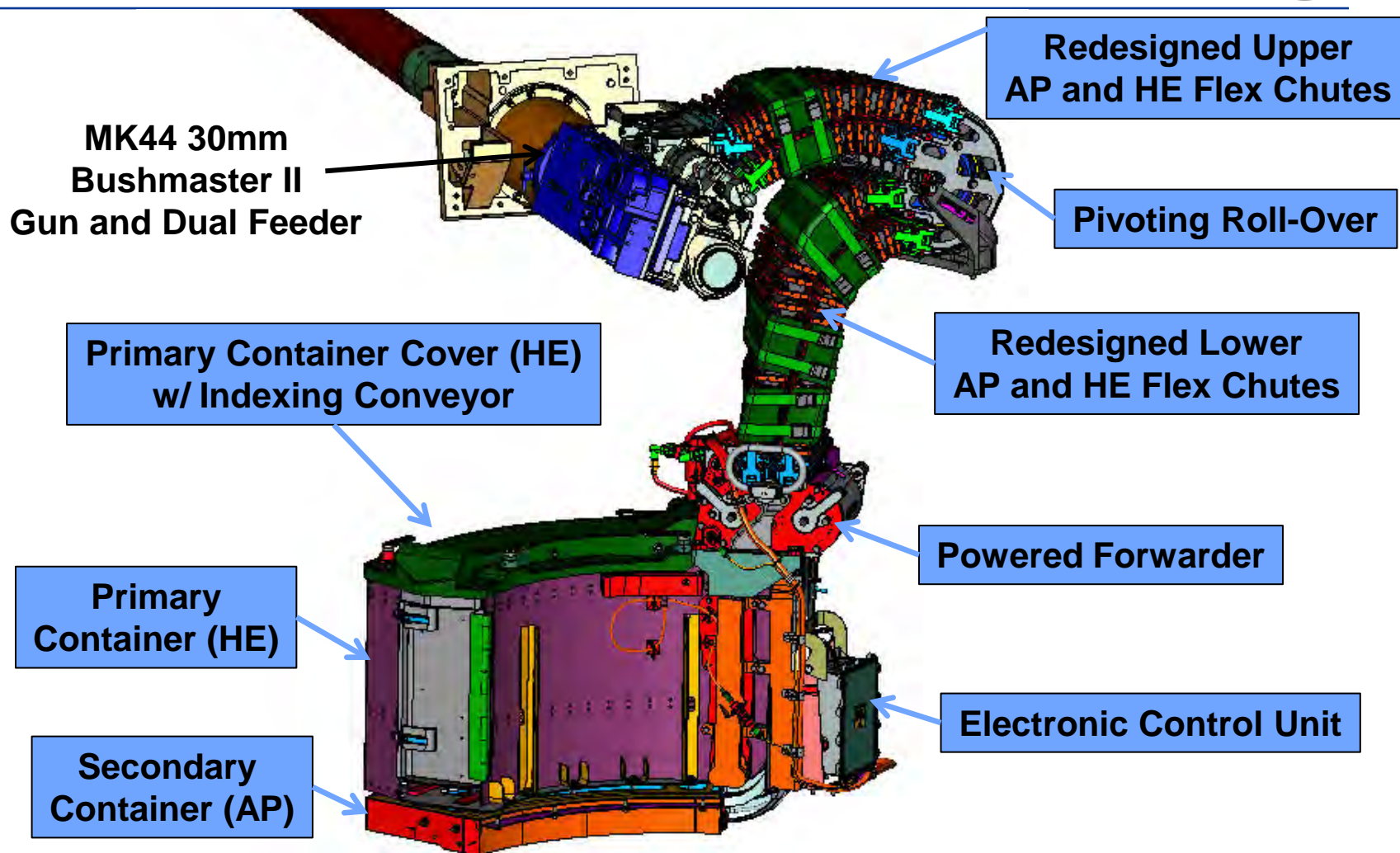
- ↗  $\geq 22,000$  (MRBOMF)





# EFV Design Overview

## -Current AFS Configuration



# EFV Testing Summary

## - AFS Brassboard



### ● Cycle Testing

- ↗ ~10,000 rounds cycled
- ↗ HE can resistance characterized
- ↗ HE can index function characterized
- ↗ Booster function characterized
- ↗ Cycle tested both HE & AP sides
- ↗ Loading assessment with vehicle mock-up
- ↗ 31° Tilt Test
  - HE ammo can and forwarder only



### ● Identified design improvements

- ↗ Roll-Over Geometry Redesign
- ↗ HE can round positioning & retention features
- ↗ HE separator mechanism actuation method external to can

# EFV Testing Summary

## - Delivered Production Systems 1-9



- **Acceptance Testing**

- 9 systems
- GDATP EDL facility
- Engineering Pre-Test

- **Formal ATP**

- 4 gun elevations
  - $-10^{\circ}, +15^{\circ}, +30^{\circ}, +45^{\circ}$
- Cycling per elevation
  - Single Shot
  - 5 round burst
  - Continuous burst
- Download capability





# EFV Testing Summary

-Total rounds cycled per production configuration



System	Pre ATP Cycled Rounds	ATP Cycled Rounds	Post ATP Cycled Rounds	Total Rounds on System
System #1	2316	156	0	2472
System #2	1302	188	0	1490
System #3	193	158	9928	10279
System #4	107	121	0	228
System #5	120	156	73	349
System #6	122	156	0	278
System #7	193	251	0	444
System #8	206	307	0	513
System #9	274	402	0	676
<b>Totals</b>	<b>4833</b>	<b>1895</b>	<b>10001</b>	<b>16729</b>
<b>Total rounds cycled on Turret #1 (including brassboard) as of 4/25/2010</b>				<b>26735</b>

# EFV Testing Summary

## - Follow On Engineering Testing Design Upgrades



- **6 Design Areas Identified for Upgrades on Delivered Systems**

- HE Cover
- HE Separator Handle
- ECU Firmware
- HE Container
- Pivoting Roll-Over Sprocket
- Forwarder Clutch

- **Retrofit Activity**

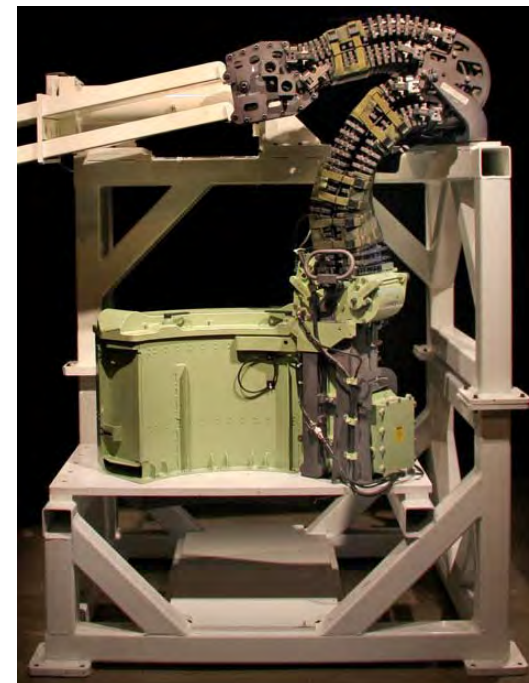
- Delivered systems were returned to GDATP for retrofit
- Two week turnaround time per system
- Upgrade activity occurred from February through April 2010.
- All Systems have been retrofitted and returned to GDAMS.



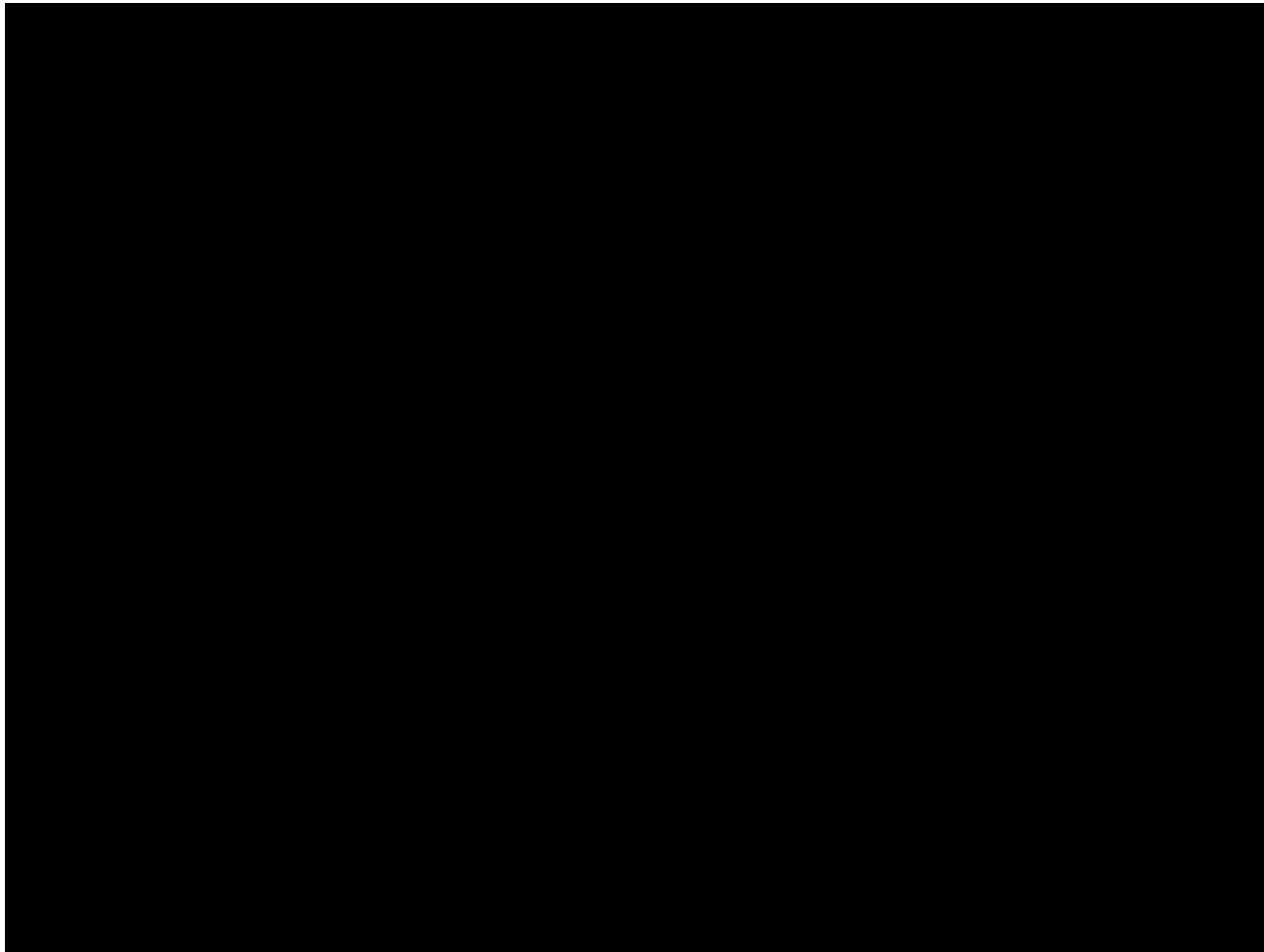


# Key Program Milestones

- **Contract Award: November 2007**
- **PDR: March 2008**
- **Brassboard Hardware Testing**
  - Sept. 08 - Jul. 09
- **CDR: Sept. 2008**
- **Production Acceptance Testing**
  - Aug. – Dec. 2009
- **Live Fire Demonstration**
  - October 2009 at the GDATP Ethan Allen Firing Range
  - Representatives from GD Amphibious Systems (GDAMS), Marine Corps EFV Program Office, Government Accountability Office (GAO) and local media.



# Live Fire Demonstration





# EFV AFS Path Forward

- **GDATP Supplier Retained Unit**
  - **Complete Engineering Testing**
    - 10,000 rounds cycle test in the GDATP Engineering Development Laboratory (EDL)
    - Testing will include efforts in a 31° tilt stand.
  - **Conduct Environmental Qualification Testing**
    - Testing consists of Shock, Vibration, Underwater Mine Blast, Temperature, High Pressure Spray and Salt Fog
- **Delivered Units**
  - **Operational Assessment (OA) Summer 2010**

# Questions?





# **MK 51 MAWS**

## **Modular Advanced Weapon System**

17 May 2010

**Steven J. Cannon**  
**NSWC/Port Hueneme Division**  
**Louisville Detachment**



# Agenda

- **Recap of the Origin of the MK 51 Weapon System**
- **Patrol Coastal Installation and Firing Event**
- **Path Forward for the MK 51**
- **NAVAIR Path Forward for the M230 30mm Cannon and Ammunition**

# MK 45 Weapon System



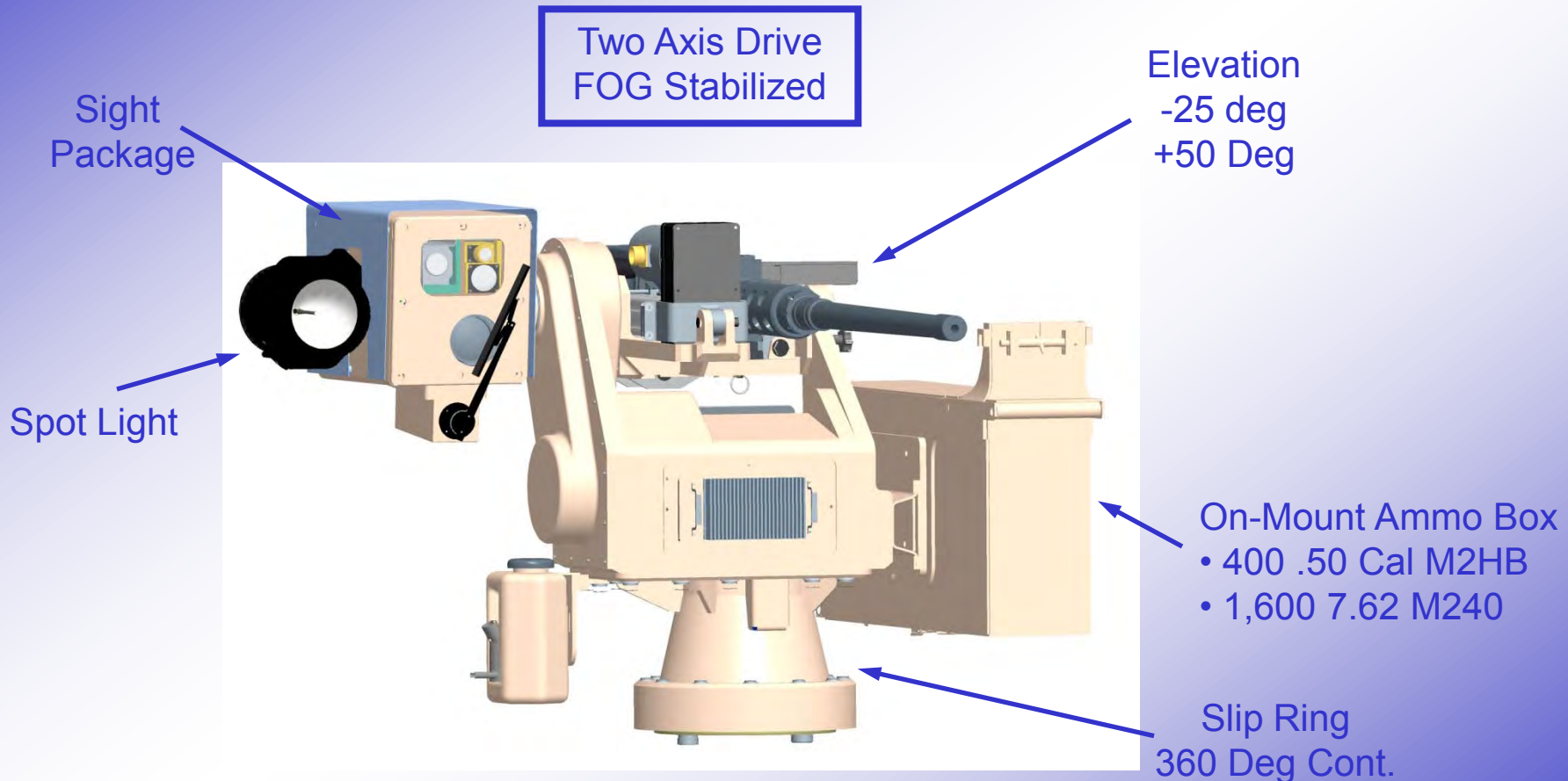
HSV 2 SWIFT



USCG 87' Patrol Boat  
COCHITO

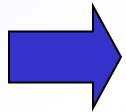
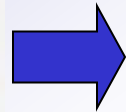
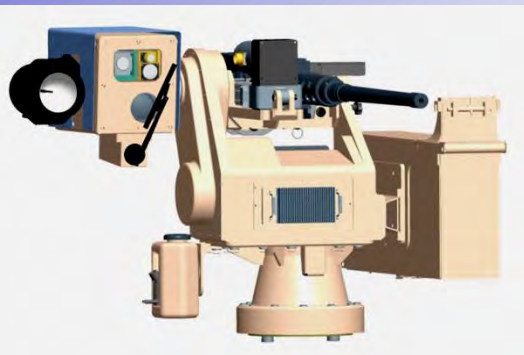
# Naval Expeditionary Overwatch (NEO)

## Gunslinger Spiral 3 Mount

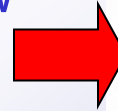


Mount Weight Approx. 265 (No Gun or Ammo)  
Overall Dimensions with M2HB = 29.4"H x 38"W x 65.2"D  
Working Radius with M2HB = 42.2"

# Modular Advanced Weapon System (MAWS) Development



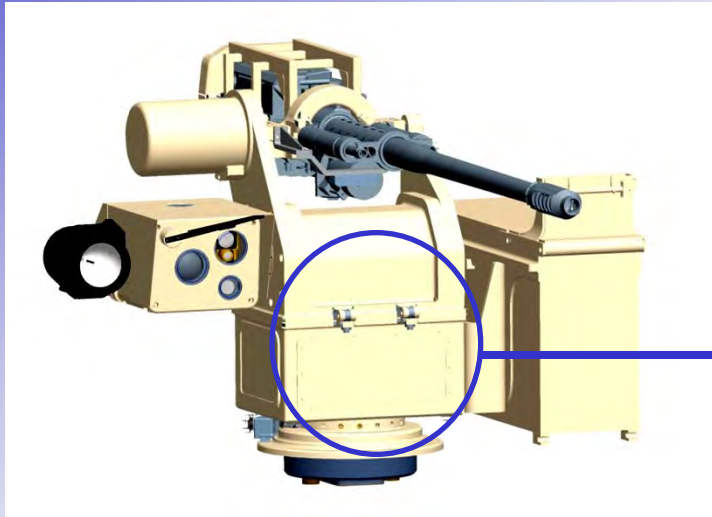
Repackage current  
MK 45 and MK 45 LW  
Systems and add  
new capabilities Into  
a new Modular Advanced  
Weapon System (MAWS)





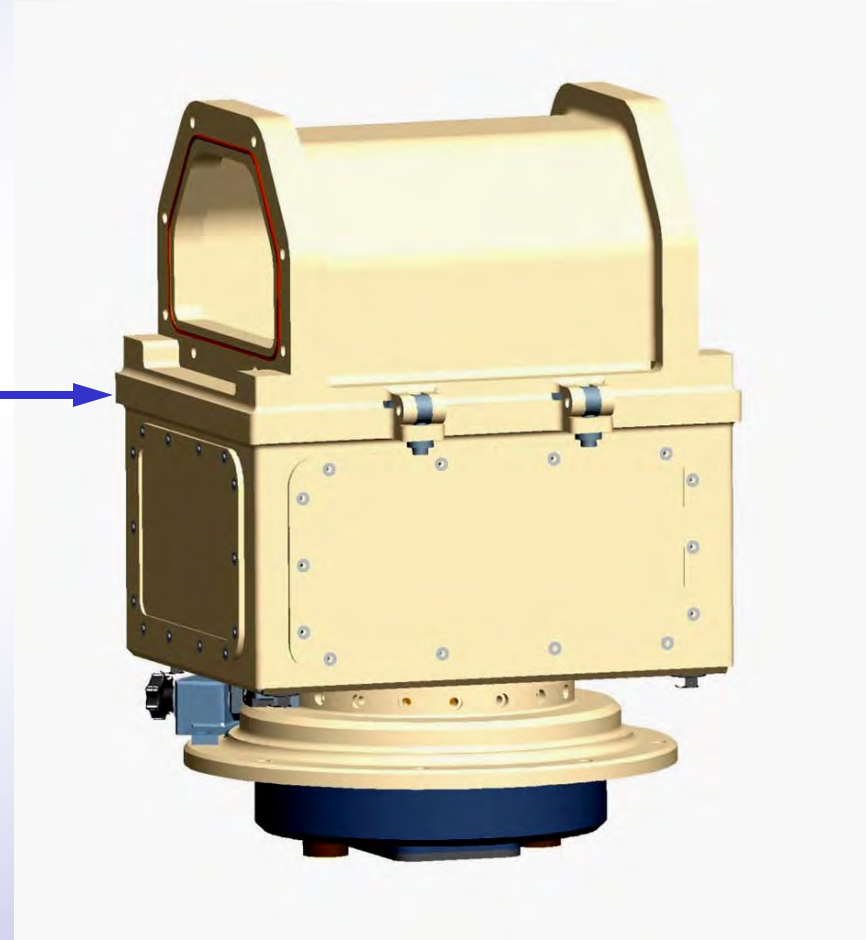
# Modular Advanced Weapon System (MAWS)

## Common Base Assy



Base Structure Contains:

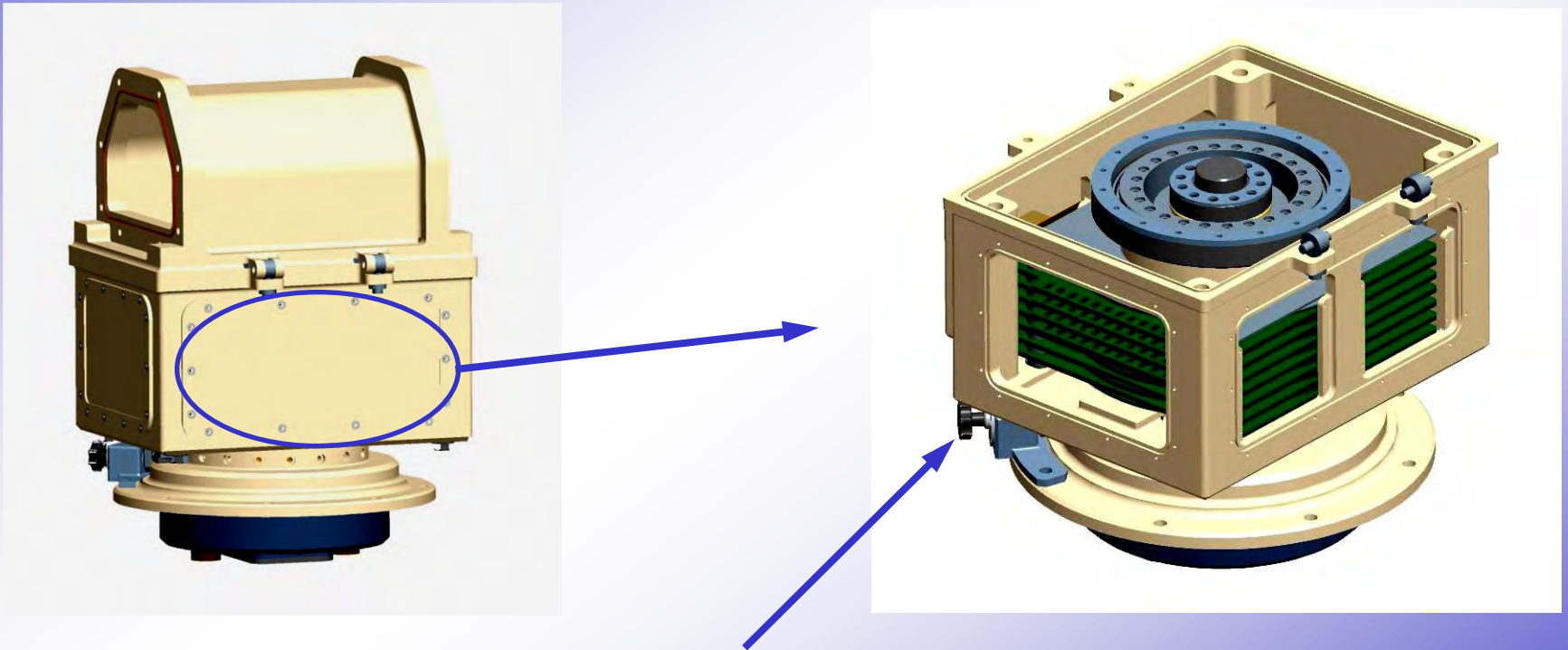
- Azimuth power drive
- Slip-Ring
- In gimble electronics (Amp Box)





# Modular Advanced Weapon System (MAWS)

## Integral Slip Ring



Scaleable slip-ring design allows the addition of circuit paths as needed for payload requirements

# Modular Advanced Weapon System (MAWS)

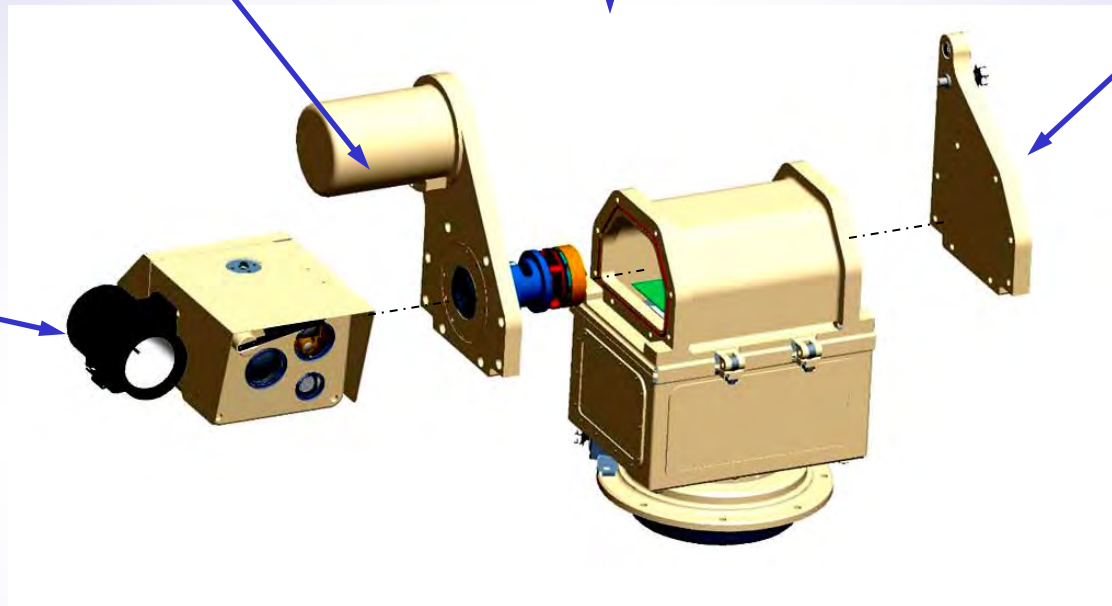
## Three Axis Configuration

Three Axis Drive Trunnion Assy  
contains independent sight  
and payload drives



Support Trunnion

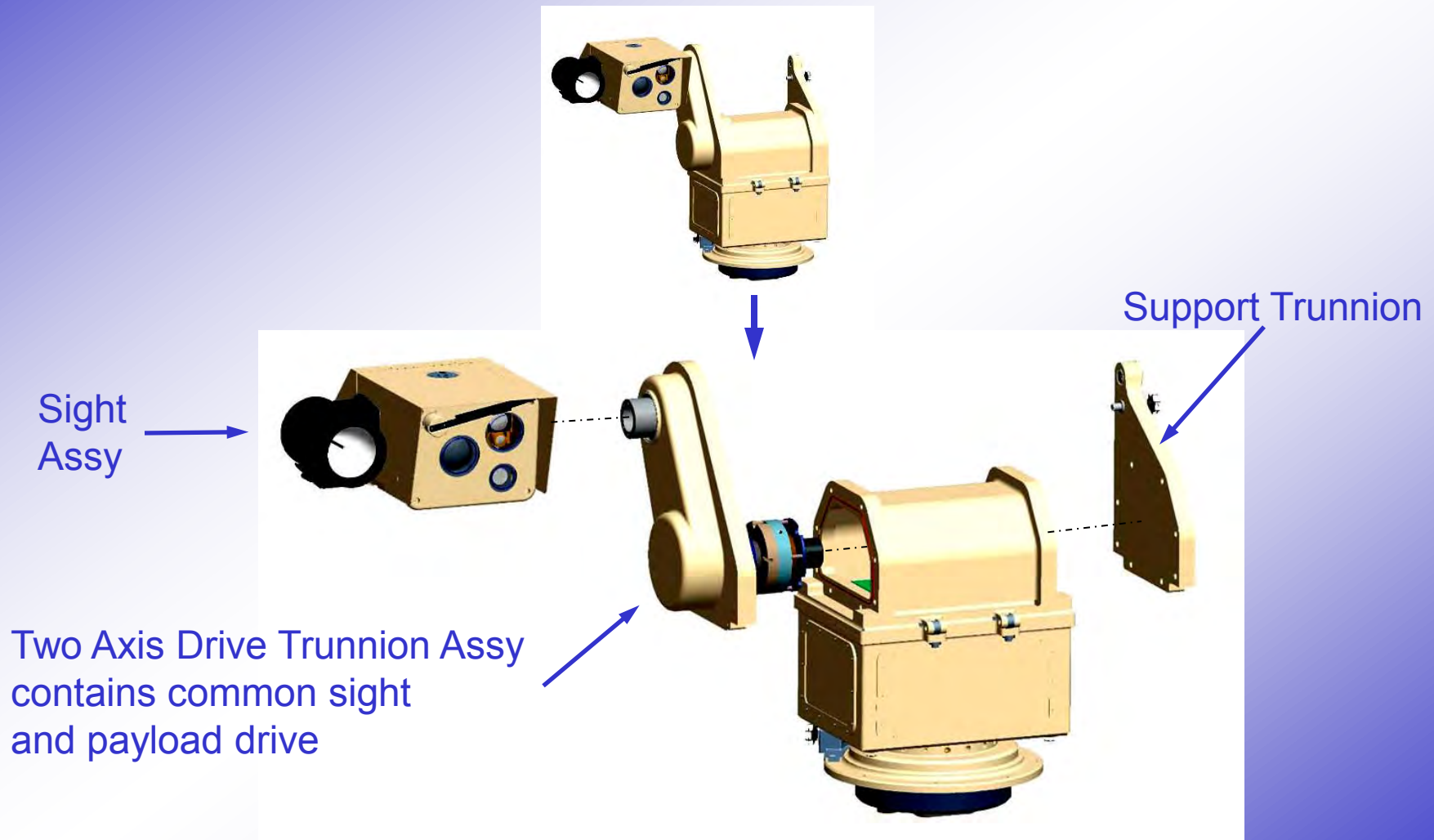
Sight  
Assy



Common Mechanical and Plug and Play Electronic Interfaces

# Modular Advanced Weapon System (MAWS)

## Two Axis Configuration

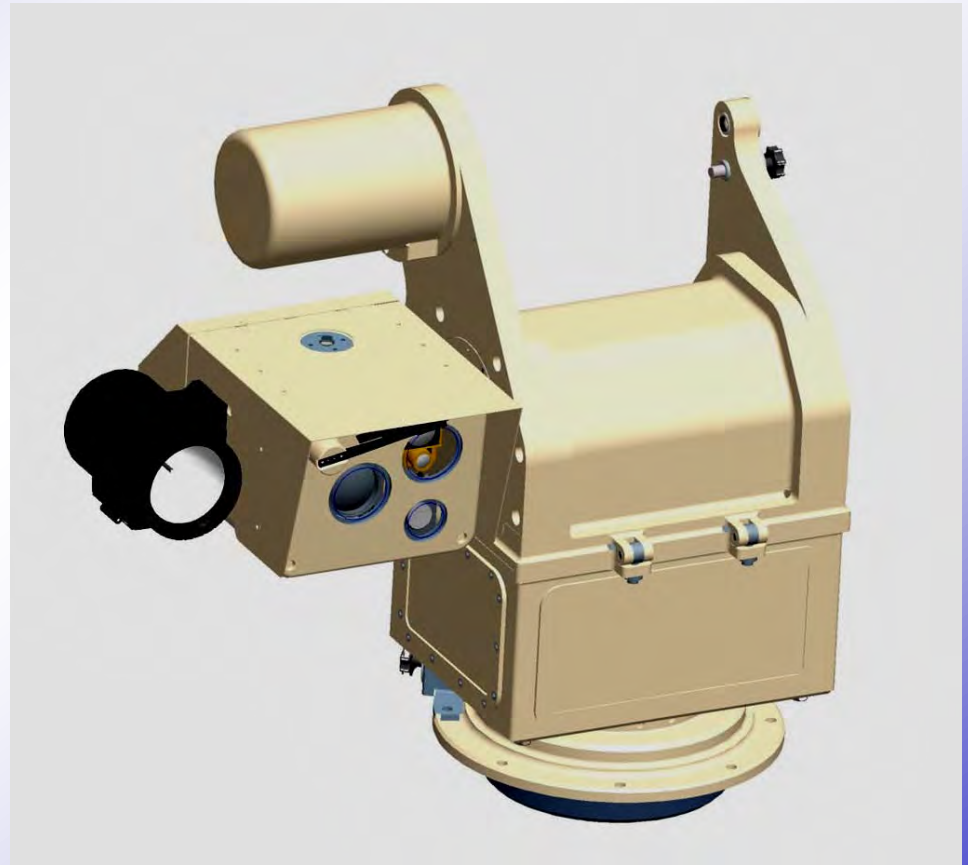


Common Mechanical and Plug and Play Electronic Interfaces

# Modular Advanced Weapon System (MAWS)

## Sight Interface

- Sight interface has common mechanical and electrical interfaces for plug and play compatibility between sight packages



# **Modular Advanced Weapon System (MAWS)**

## **Principle Concept**

- **Modular Advanced Weapon System**
  - **Modular/Scaleable design is adaptable to many payloads and various performance requirements**
  - **Lightweight**
    - **Baseline construction – Aluminum weldments, castings when possible**
    - **Objective – Composite manufacture when possible**
      - **Composite Study Funded**
  - **Cost**
    - **Modular design allows configuration options that satisfy cost/performance requirements**



# Modular Configuration Options

M2HB .50 cal



M240 7.62



MK 19 40mm



Common Base  
Assy



M230LF 30mm



M134 7.762mm Gatling Gun



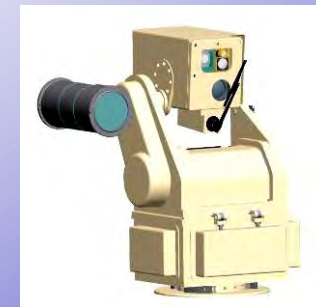
Long Range Acoustical Device  
LRAD 500 and Optics Package



LW25 25mm with LRAD 500



Surveillance Payload  
w/ Alternative Spotlight



# Patrol Coastal At-Sea Demonstration

- **Funded by IWS3C**
- **Supported by PCRON**
- **Objectives**
  - **Safely demonstrate the advantages the MK 51 Weapon System**
    - Optics
    - Remote operation
    - Stabilization
    - Location improvement
    - Ability for ship's crew to remove and stow the cannon
- **Schedule**
  - **TEMPALT SIDs finalized by 15 May**
  - **Install TEMPALT 01-24 June 09**
  - **Install MK 51 31 Aug – 4 Sept 09**
  - **Demonstrated Sept 09**

# **Demonstrated Weapon Choice**

# ATK M230LF

- **Details:**

- 30mm Chain Gun
- Effective Range - ~2,500 Yards
- Lightweight - Approx. 160 lbs
- Fires electric primed ammunition
- M230 linkless Chain Gun used on Army AH-64 Apache Helicopter and MH-60 Aircraft
- M230LF variant being applied to this program is derived from the M230 with the follow modifications:
  - Modified feeder for linked ammunition
  - Added recoil attenuation buffers
  - Percussion firing mechanism – upgrade kit

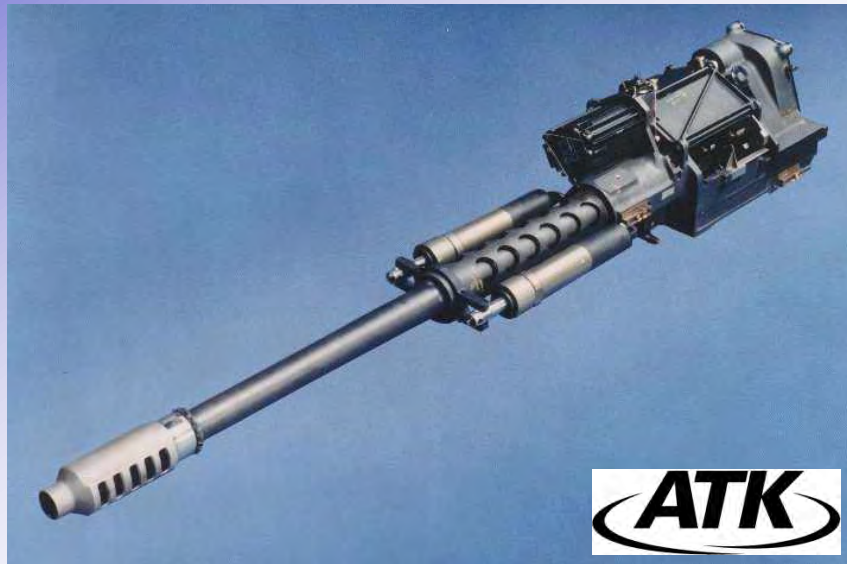
- **Known Issues:**

- M230LF Not Type Classified
- Requires some degree of design finalization by ATK
- Level of Marinization unknown





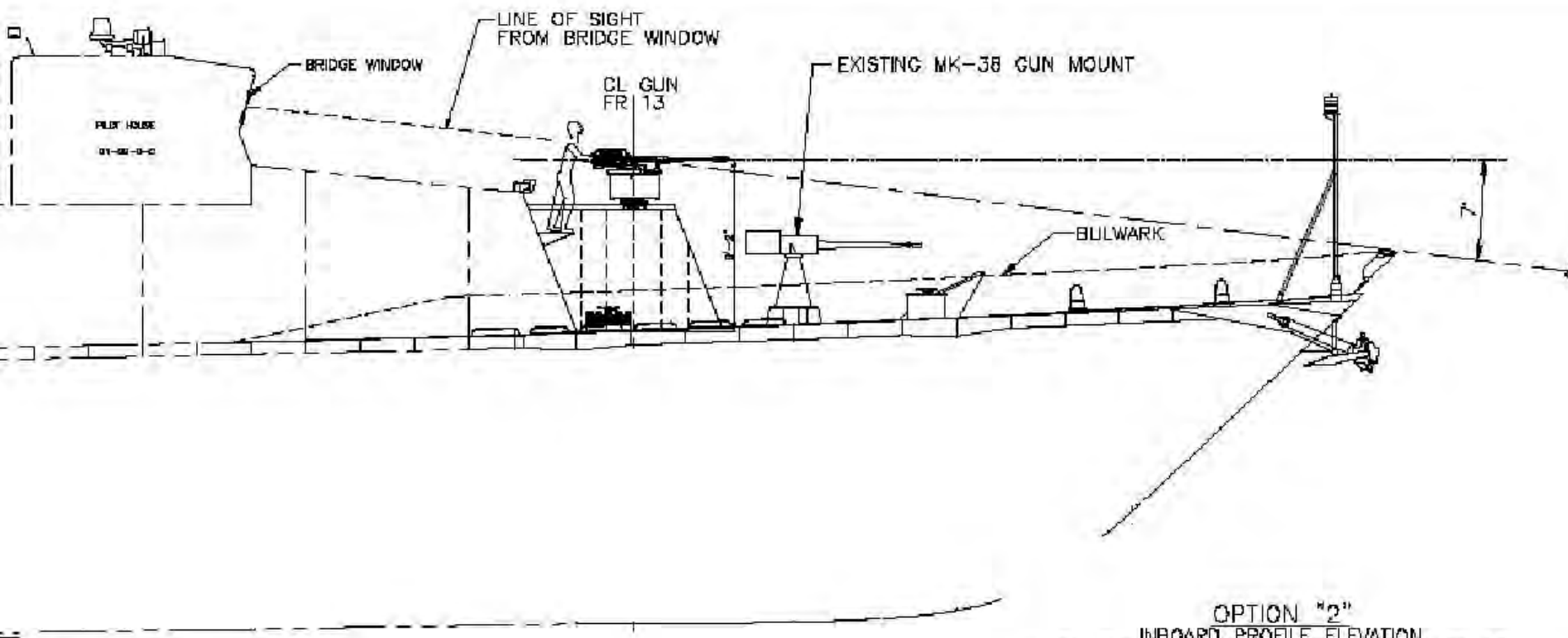
# MK 51 Weapon System w/M230 Integrated



MK 51/MAWS



# **PC Location Option for Sept 09 Demonstration**



OPTION "2"  
 INBOARD PROFILE ELEVATION  
 (N) GUN INSTALLED FWD ELEX RM @ FR 13  
 W/ NEW PLATE/DK HSE  
 4" HIGH GUN FOUNDATION

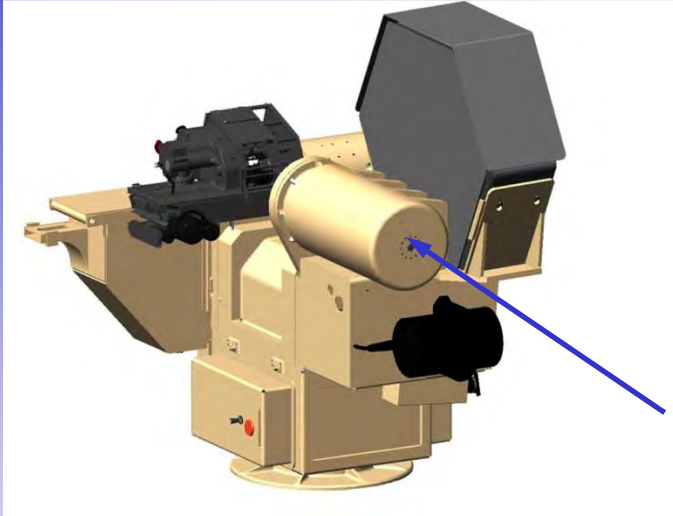
# USS HURRICANE PC 3 Installation



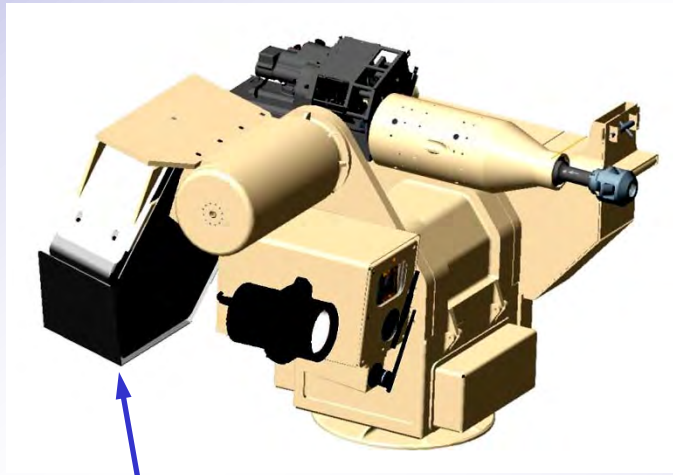
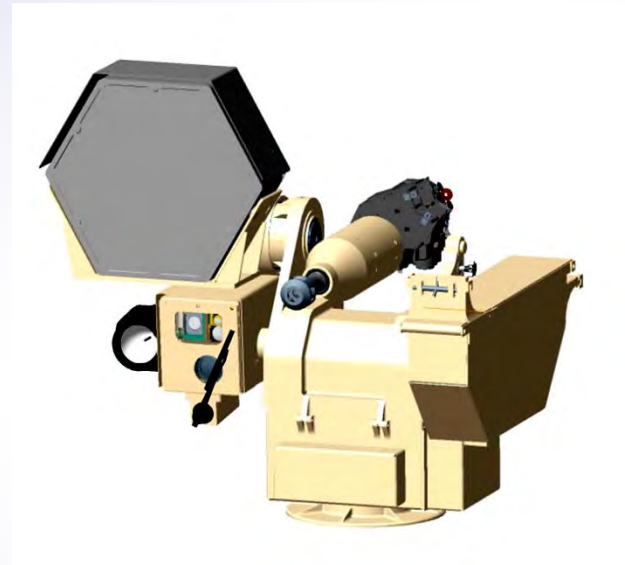
## **Additional Features Under Consideration**

# Modular Advanced Weapon System (MAWS)

## Auxiliary Drive



Auxiliary  
Elevation  
Drive



Stowed Position

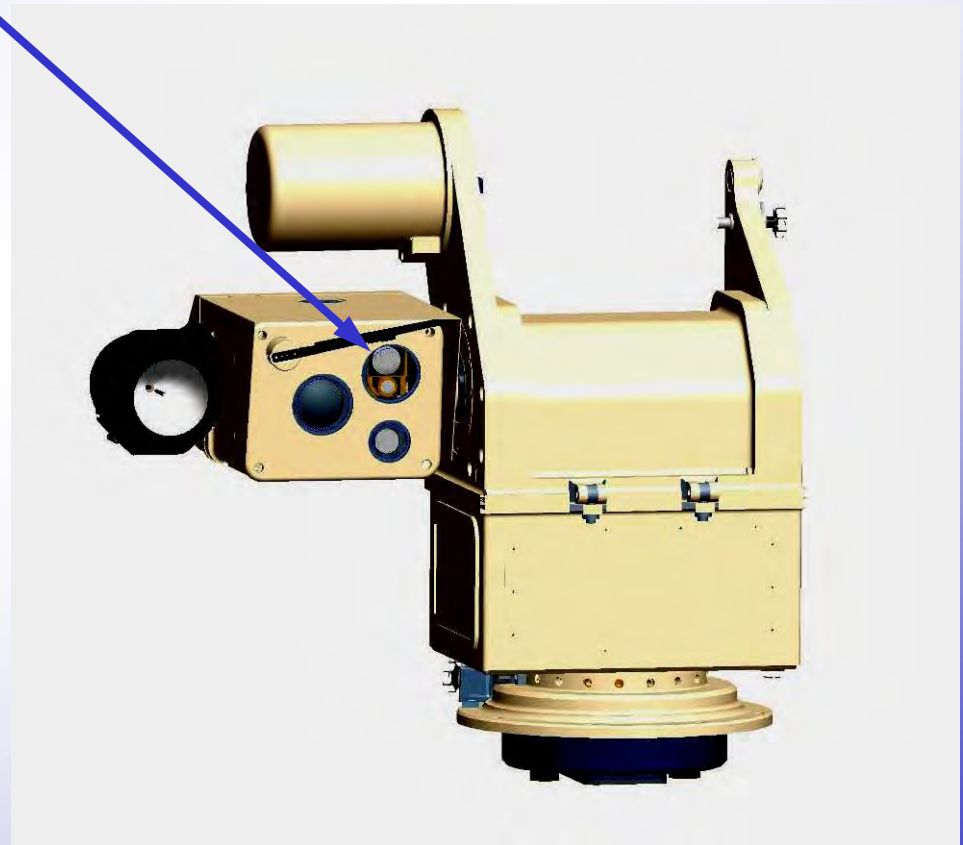
Proposed configuration for NEO Spiral 2  
to support escalation of force initiative



# Modular Advanced Weapon System (MAWS)

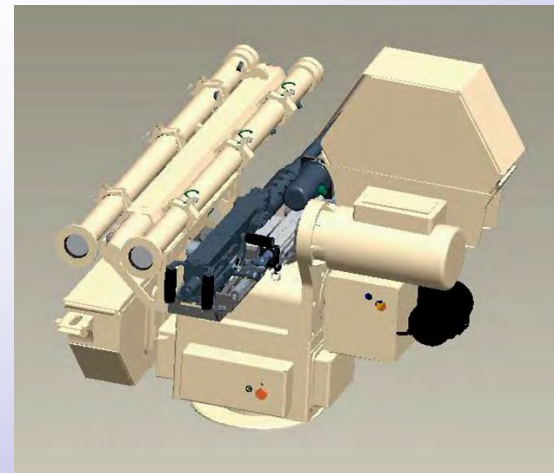
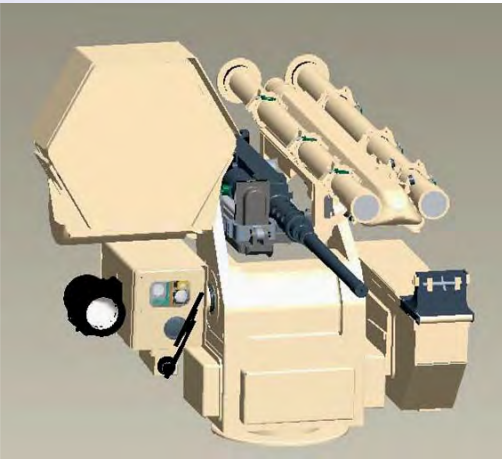
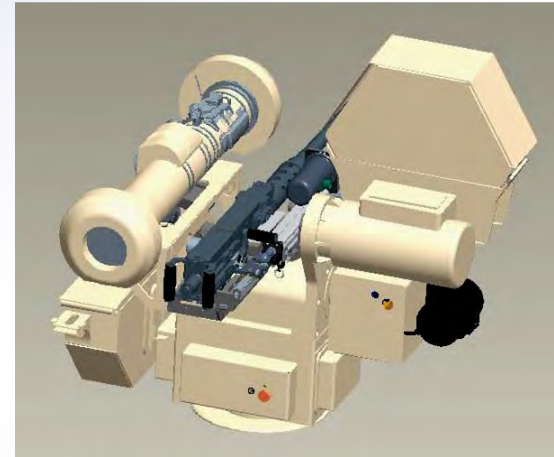
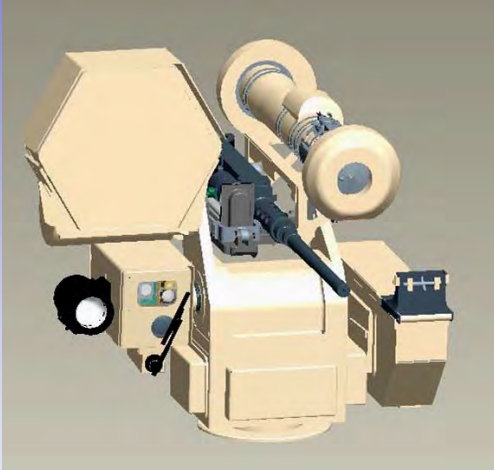
## Laser Designator/Sight Improvements

- Integrate a combination ELRF and designator into the current sight package
- Add an azimuth drive system for the sight to improve the stabilization of the sight
  - Verify accurate designation
  - Allow active target leading



# Modular Advanced Weapon System (MAWS)

## Missile Options





Captain Chris Albright

Deputy Program Manager

Email: [christopher.albright@navy.mil](mailto:christopher.albright@navy.mil)

[christopher.albright@navy.smil.mil](mailto:christopher.albright@navy.smil.mil)

DSN: 757-7412

Comm: 301-757-7412

# Requirement

- **\$3.76M FY10 RDT&E for "M230 30mm Chain Gun Automatic Cannon" on Navy MH-60S aircraft**
- **The 30mm M230 weapon is ultimately desired by fleet, but ammo and gun breech are not HERO-compatible and must be re-designed and qualified for shipboard use.**
- **PMA-242/299 will execute plan to qualify an M230 gun breech and 30 mm ammunition that meets shipboard HERO requirements.**



# Program Plan

- **2<sup>nd</sup> Qtr FY10 Received 18,000 rds of XM950 percussion primed LW30MM TP ammunition from the Army.**
- **4<sup>th</sup> Qtr FY10 Procure 2 percussion fired M230 Chain guns**
- **2<sup>nd</sup> Qtr FY11 Tentative gun qualification ground testing to begin**
- **4<sup>th</sup> Qtr FY11 Finalize TDP and present solution to PMA-299 for A/C integration**



# M230 Qualification



- **Gun System qualification test data to support WSESRB Qualification**
- **Ammunition Feed system testing**
- **Intent to pursue percussion primed ammunition qualification**

Questions?



# #10595 - Gun Tube Wear Reduction for 105 mm Artillery

May 18<sup>th</sup>, 2010

**Thomas Boncompain**  
Project engineer  
450-581-3080 ext. 8507

# PRESENTATION SUMMARY



- **Initial Problem**
- **Gun Wear Mechanism**
- **Technical Approach**
- **Selected Wear Reducing Additive**
- **Selected Liner Design Configurations**
- **Barrel Measurement Assessment**
- **Test Results**
- **Way Ahead**
- **Conclusion**

# INITIAL PROBLEM



## ■ System Description

- Cartridge -105 mm C132 ER Artillery

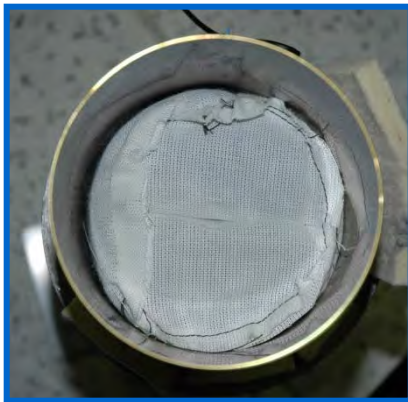
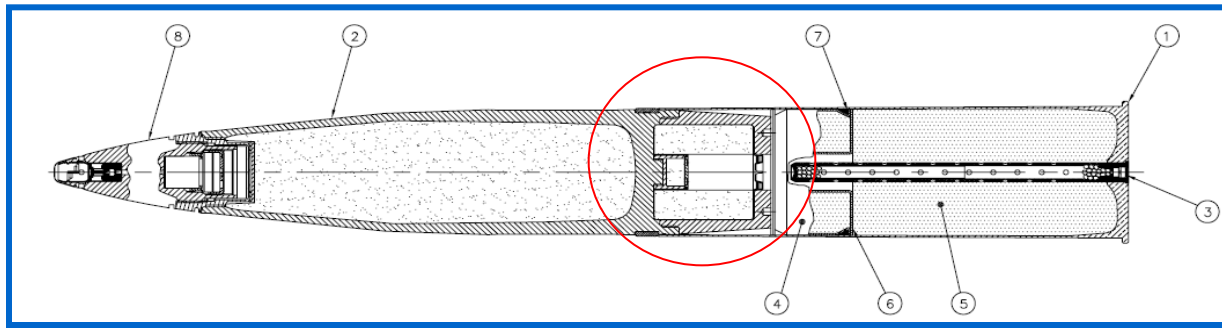
	Muzzle velocity	Range	Propellant
Zone 1	579 m/s	14.4 km	Bulk Propellant
Zone 2	733 m/s	18.5 km	Bagged Propellant



# INITIAL PROBLEM



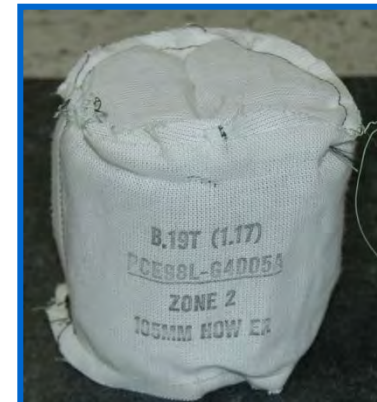
## Cartridge description



**Propellant Bag**



**Bulk Propellant  
retained by a  
Combustible Separator**



**Propellant Bag**



# INITIAL PROBLEM

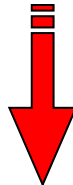


## ■ Problem Description

High Wear Rate: 1  $\mu\text{m}$  /shot



Reduced Gun Performance



Frequent Barrel Replacement



Increased Lifecycle Costs

# GUN WEAR MECHANISMS



## Wear

### Thermal

- Gas Temperature
- Heat Transfer
- Firing Rate

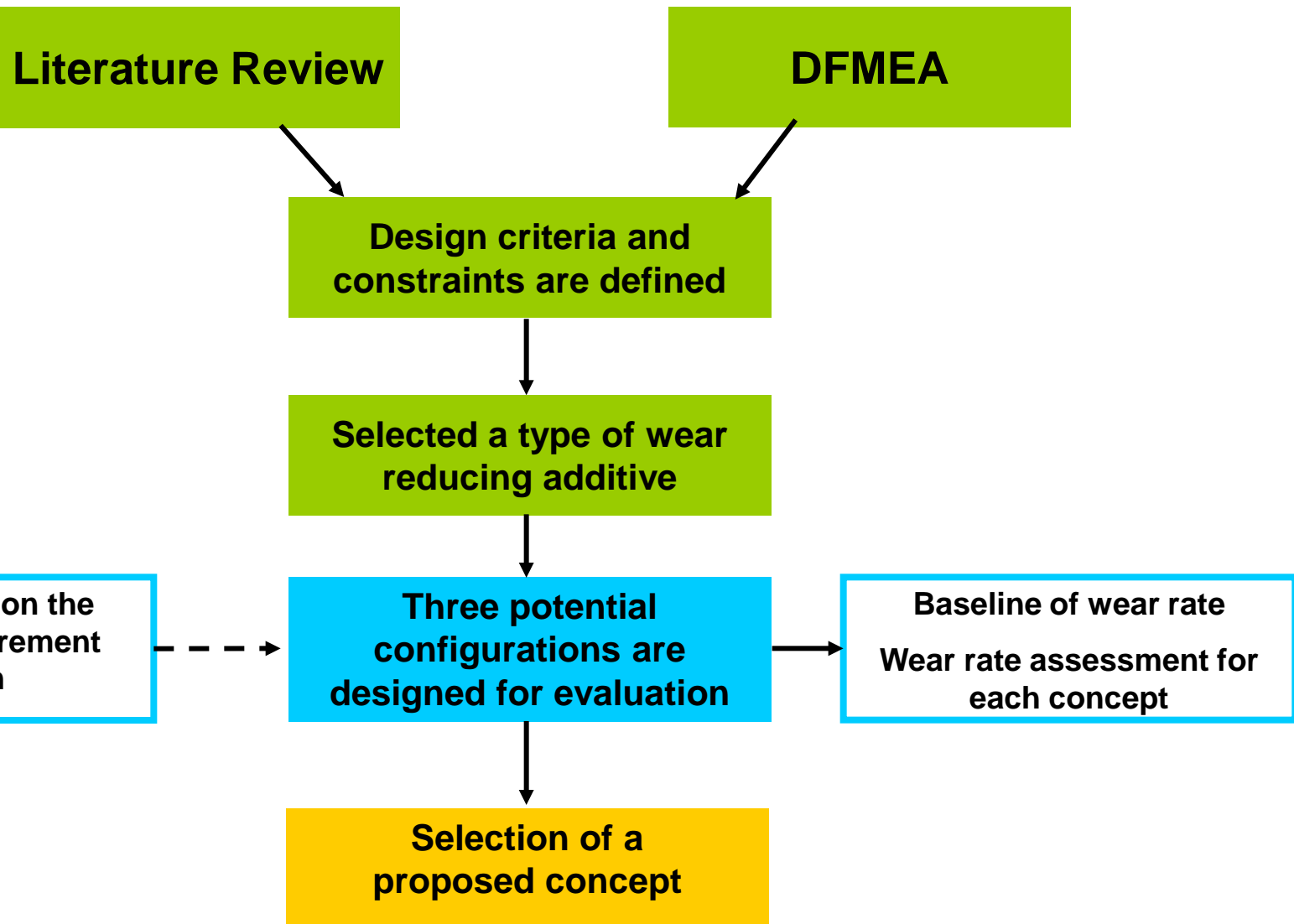
### Mechanical

- Gas Pressure
- Driving Band Engraving and Projectile Sliding Resistance

### Chemical

- Products of Combustion

# TECHNICAL APPROACH





## ■ LITERATURE REVIEW

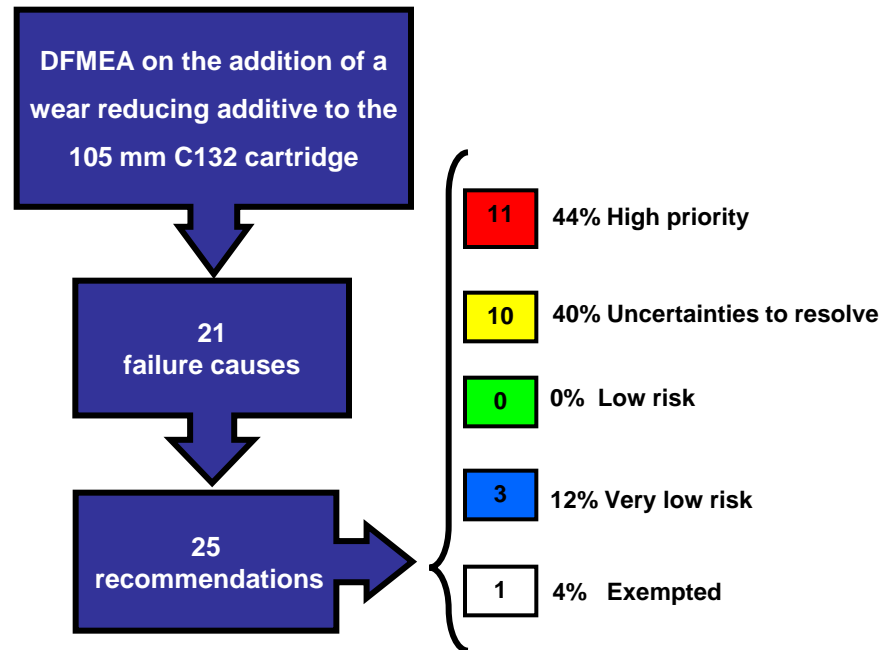
- Better understanding of barrel erosion mechanism (thermal, mechanical, chemical)
- Review of the various wear reduction additive and performance
- Wear reducing liner manufacturer is contacted: Akers Krutbruk (Swedish additive:  $\text{TiO}_2$  /wax)
- Design criteria and constraints are established





## DFMEA

- DFMEA: Analysis method used in engineering to document and explore ways that a product design might fail in real-world use



- Recommendations resulted in the following:
  - Test to be performed (vibration, compatibility, BBU...)
  - Design criteria's and constraints (positioning, quantity...)



## ■ Most important Design Criteria's and Constraints


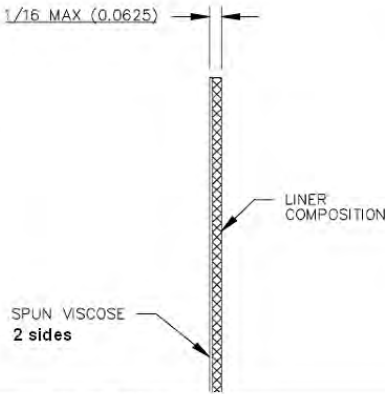
- No wear reducing additive should be positioned in front of the BBU
- Wear reducing additive should weight no more than 4% of Full Charge
- Positioning is more important than quantity
- Additive should be placed further ahead of the charge as possible
- The combustible separator of the bulk propellant shall not be removed

- DFMEA  
- Akers Krutbruk  
- Literature review

# SELECTED WEAR REDUCING ADDITIVE



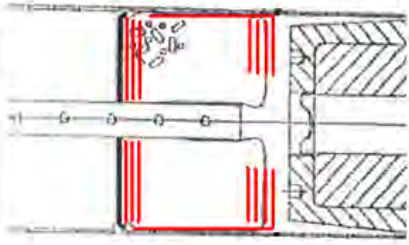
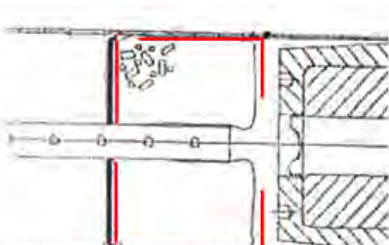
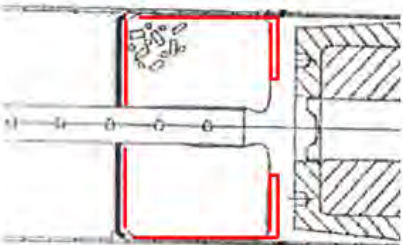
- Wear reducing candidates: Talc/wax;  $\text{TiO}_2$ /wax; Polyurethane foam
- $\text{TiO}_2$ /wax is the best wear reducing candidate for the 105 mm HE C132 based on available information and historical results on similar applications.
- Two suppliers are identified for this product:
  - GD-OTS Canada
  - Akers Krutbruk

Additive ( $\text{TiO}_2$ /wax)	Akers Krutbruk	GD-OTS Canada
<i>Drawing</i>	 <p>The wear reducing additive</p> <p>1. Gauze/fibers reinforced 2. Titaniumdioxid, wax and dispersion agent 3. Plastic sheet (Polyester)</p>	 <p>1/16 MAX (0.0625)</p> <p>LINER COMPOSITION</p> <p>SPUN VISCOSE 2 sides</p>
<i>Chemical composition</i>	Titanium dioxide 45-55 % Microwax 45-55 % Stearyl alcohol 0,5-1,5 % Rayon fabric Polyester foil	Titanium dioxide 55.2 % Paraffin wax 45.3% Stearyl alcohol 10% of mix max. Cloth spun viscose Gauze reinforcement
<i>Melting point</i>	Melting point 85 - 95 (°C)	Melting point 56 - 59 (°C)

# SELECTED CONFIGURATIONS FOR EVALUATION



- 3 configurations are proposed for test evaluation
- Liner positioning will be above the combustible separator
- Addition of a wear reducing liner around the removable charge
- The liner will not be glued to the cartridge case

Configuration	C1 - LG	C2 - LG	C3 - AK
Layout			
Supplier	<b>GD-OTS Canada</b>	<b>GD-OTS Canada</b>	Akers Krutbruk
Additive weight	76 g	44 g	61 g
% Charge weight	3.7%	2 %	2.8 %
Full charge weight	2 052 g	2 152 g	2 152 g

 **Reduced Charge Weight**

# BARREL MEASUREMENT ASSESSMENT



- Gauge R&R measures the amount of variability induced in measurements by the measurement system itself**

## **Gage R&R results**

- Improvement of the repeatability of the Bore Gage
- Increased number of measurement at critical location (2763 mm)

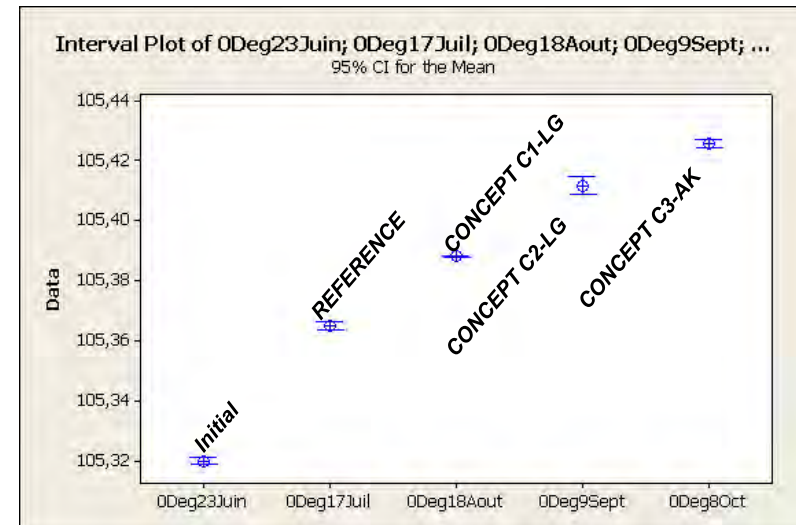
## **Required shots per evaluation**

- Statistical analysis to determine the required number of rounds to fire per concept

## **Measurement location for sentence on wear rate reduction performance**

- 2763 mm from the muzzle face

Distance from the muzzle face	Angles	Number of measurements per Land	Number of measurements per Groove
30 mm	0° et 90 °	3	3
100 mm	0° et 90 °	3	3
1400 mm	0° et 90 °	3	3
2550 mm	0° et 90 °	3	3
2610 mm	0° et 90 °	3	3
2763 mm	0°, 45°, 90°, 135°	10	3





# TEST RESULTS



## Areas of concern

- **BBU Performance:** Following 55 shots of the standard 105 mm C132 and 163 shots of the 105 mm C132, all the BBU initiated without any evidence of malfunction
- **Pressure:** There is a slight increase in pressure
- **Muzzle velocity:** No effect on muzzle velocity for equivalent full charge therefore the range is maintained

Configuration	Pressure at +21 °C in LGI (SD)	Propellant charge state	Muzzle velocity at +21 °C <i>Req. 715 ± 8 m/s</i>		Measured wear rate	
			Average	Standard deviation	Absolute	Reduction %
Reference (no liner)	297 MPa (3.8)	Full	713.4	1.5	0.977 µm / Shot	-
4 % with liner C1-LG	275 MPa (2.0)	Reduced	690.5	2.6	0.477 µm / Shot	50.00 %
2 % with liner C2-LG	300 MPa (4.8)	Full	713.5	1.8	0.588 µm / Shot	38.75 %
3 % with liner C3-AK	301 MPa (3.5)	Full	713.6	1.5	0.422 µm / Shot	55.00 %

# TEST RESULTS



## ► Liner Concept Advantage and Disadvantage Comparison

Configuration	C1- LG (4%) (- 50% wear)	C2 - LG (2%) (- 39% wear)	C3 – AK (3%) (- 55% wear)
Wear rate performance	++	+	+++
Firing table required	yes	no	no
Range	- 544 m	+ 0	+ 0
Pressure @ + 21°C	OK	OK	OK

# TEST RESULTS



## ■ Preferred Wear Reduction Additive (3% charge weight)

- C3-AK : Liner Akers Krutbruk with no effect on range
  - ( + ) 18.5 km range maintained
  - ( + ) Wear reduction of 55 %
  - ( + ) Preferred liner for the modification of the cartridge on a production line
  - ( + ) Higher liquefaction temperature

# WAY AHEAD



- Packaging and design optimization including end user input
- Preliminary vibration analysis
- Preliminary thermal cycling
- Confirmation of maximum pressures in @ +63 °C
- Reconfirmation of wear in tube between 1/8 and ¼ life @ +21°C
- Range validation following sequential environmental test



## ■ Conclusion

- With a well positioned additive with the right quantity, It is possible to reduce wear
- Our proposed solution increases barrel life by 55%
- No effect on range
- Implementing a C132 wear reduction solution is technically feasible
- Activities for the way ahead have been established
- Minimal Qualification is anticipated



# QUESTIONS





U.S. Army Research, Development and  
Engineering Command



***TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.***

Indirect Fires Precision and Lethality Enhancements through  
Digitization of Artillery and Mortar Weapon Systems

Presented by  
**Victor Galgano & Ralph Tillinghast**  
May 18, 2010

## Outline

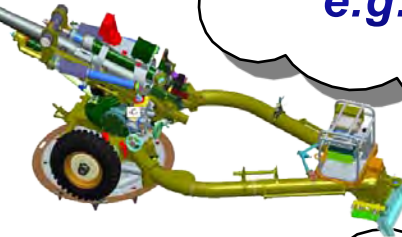
- **Fire Control Digitization** (*Presented by: Vic Galgano*)
  - Fire Control Functions
  - Indirect Fires Before Digitization
  - Digitized Systems and Their Advantages
- **Current and Future Trends** (*Presented by: Ralph Tillinghast*)
  - Smart Projectile Interface
  - The Move Toward Commonality
  - New Fire Control Technologies and Innovations



**Navigate**



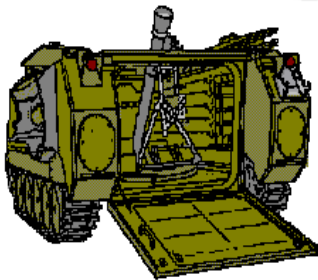
**Projectile  
Interface  
e.g. Excalibur**



**Determine/Affect  
Weapon Pointing**

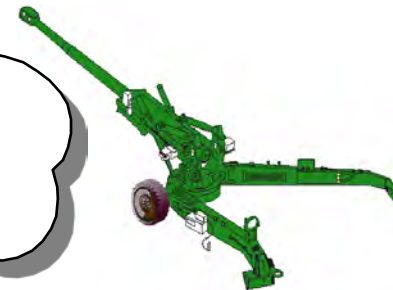
**Communicate on  
Fire Support &  
Sit Aware Nets**

**Determine  
Platform  
Position**



**Sensor Interfaces  
Data Processing &  
Display**

**Tactical &  
Technical Fire  
Control/Data  
Processing**



# Indirect Fires Before Digitization “Glass and Iron”



- Manual Precision Survey (Aiming Circles / Aiming Stakes / Collimators manually placed)
- Sight Units on weapons referenced to aiming circles
- Map navigation
- Voice communication of gun orders
- Instrument and weapon leveling / cross-leveling
- Plotting boards / Protractors / Slide rules at FDC
- Manual control of weapon aiming

***CREW-INTENSIVE OPERATIONS***



## Digital technology provides significant improvements to Indirect Fire Systems

- Digital link to Fire Support Network
  - Call for fire
  - Met data
  - Logistics data
- On Board Ballistic Computation and Sensors using Ballistic Kernel
- Automated navigation and location systems
- Automated 3-axis gun orientation
- Precise weapon aiming and automatic weapon drives (Paladin)

**SOFTWARE-INTENSIVE AUTOMATED OPERATIONS**

### M777 Towed Artillery Digitization



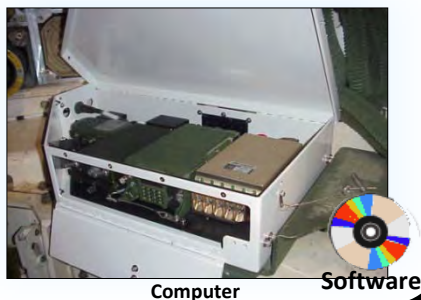
### MFCS (H) Heavy



### Paladin

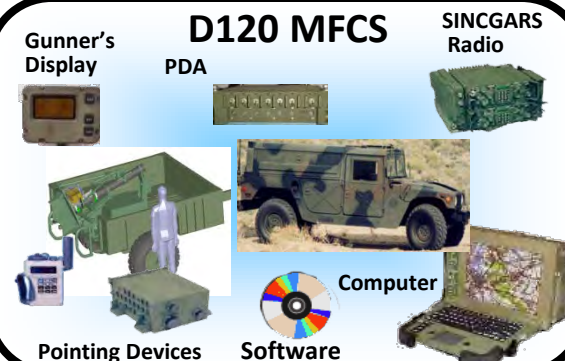


### Portable Excalibur FCS



## Indirect Fire Digitization Efforts for PM Customers

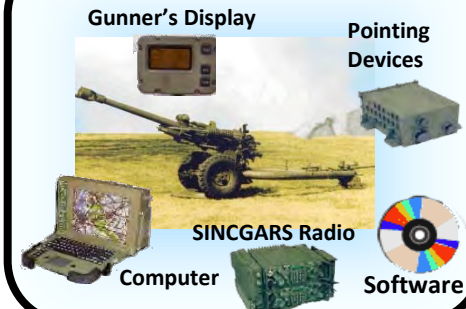
### D120 MFCS



### MFCS Stryker

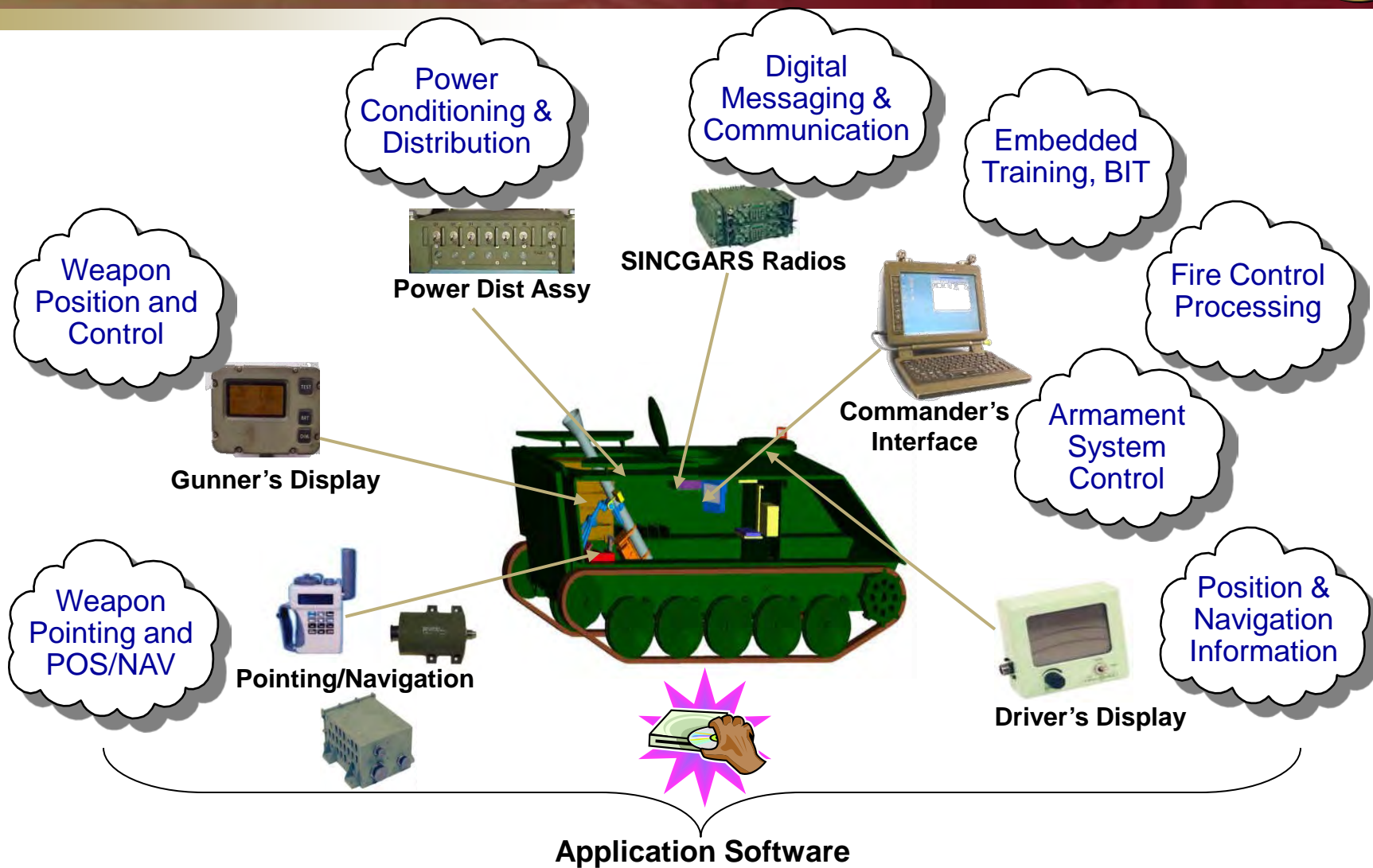


### M119 Howitzer



### LHMBC (US Army & USMC Effort)





Digitizing the M1064 through integration of Hardware and Software Components

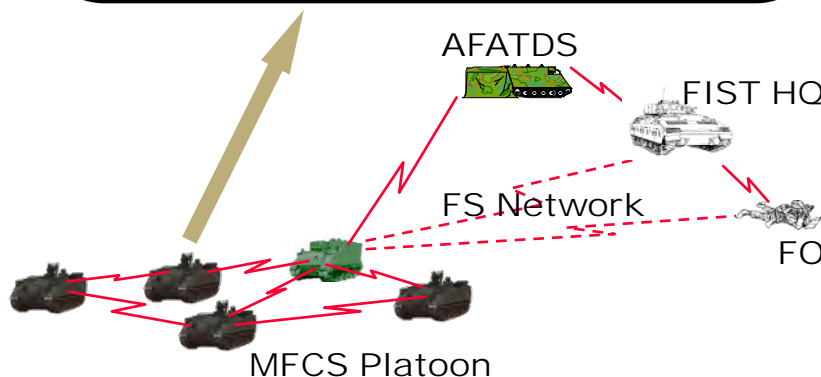
## ARDEC Approach

**In-house software development & system integration**

**IPT employed**

**EVM employed**

**Level 5 CMMI Processes**



## Significant Performance Improvements

**Improved Responsiveness (1.5 vs. 8 min)**

**Increased Survivability (No need to dismount)**

**Increased Accuracy (75 M CEP)**

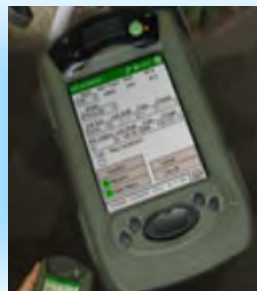
ARDEC applies digital technology providing significant improvements to mortars



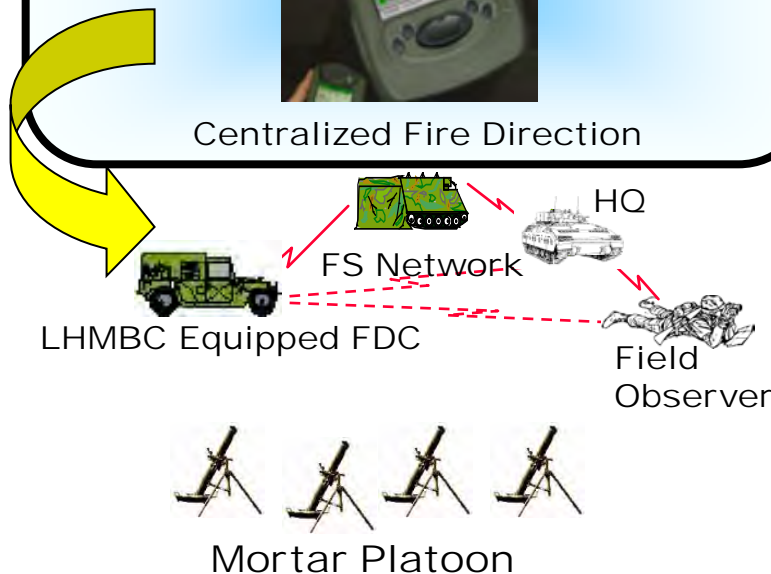
## Performance vs M23

- **Computational Accuracy 10M** (vs 25)
- **Uses Ballistic Kernel**
- **<2 lbs** (vs 8)
- **Response time 4 min** (vs 8)
- **6 simultaneous missions** (vs 3)
- **Accommodates all fielded ammo**
- **Digital connectivity**
- **MET Data**
- **Integrated GPS**

## *Replaces Obsolete M23 Computer*



Centralized Fire Direction



## Improvements In:

- Responsiveness** ↑
- Survivability** ↑
- Accuracy** ↑
- Portability** ↑
- Ease of Use** ↑

**Enables "Shoot & Scoot" Tactics**

Winner of "DoD Top 5 Program" and "Army's 10 Greatest Invention Award"



# Digitized M119 Sled Configuration - Transport

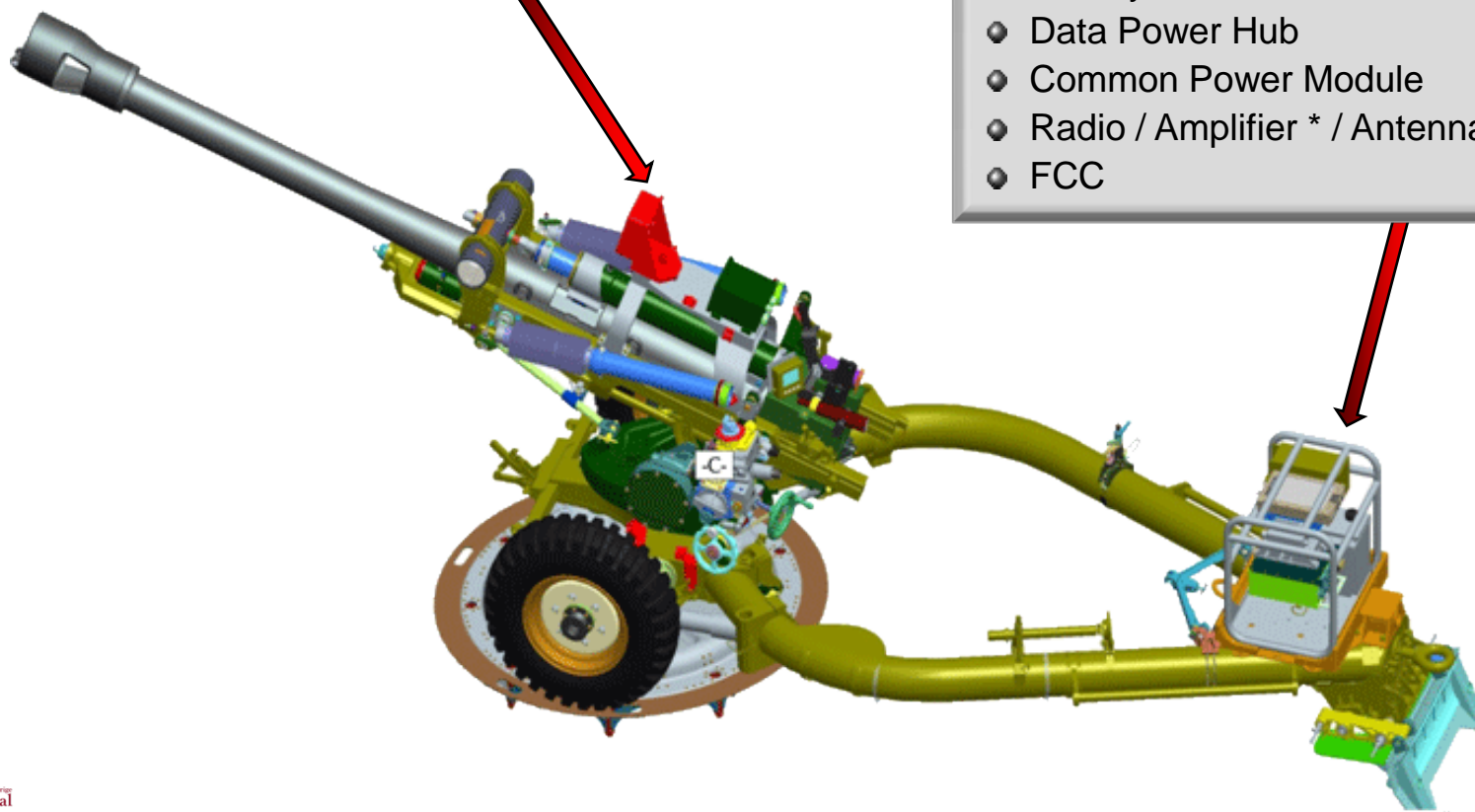


## On Carriage:

- Inertial Navigation Unit
- Muzzle Velocity Sensor
- Gunner Display

## Sled:

- iPIK
- Battery
- Data Power Hub
- Common Power Module
- Radio / Amplifier \* / Antenna
- FCC



# Digitized M119 Sled Configuration - Firing

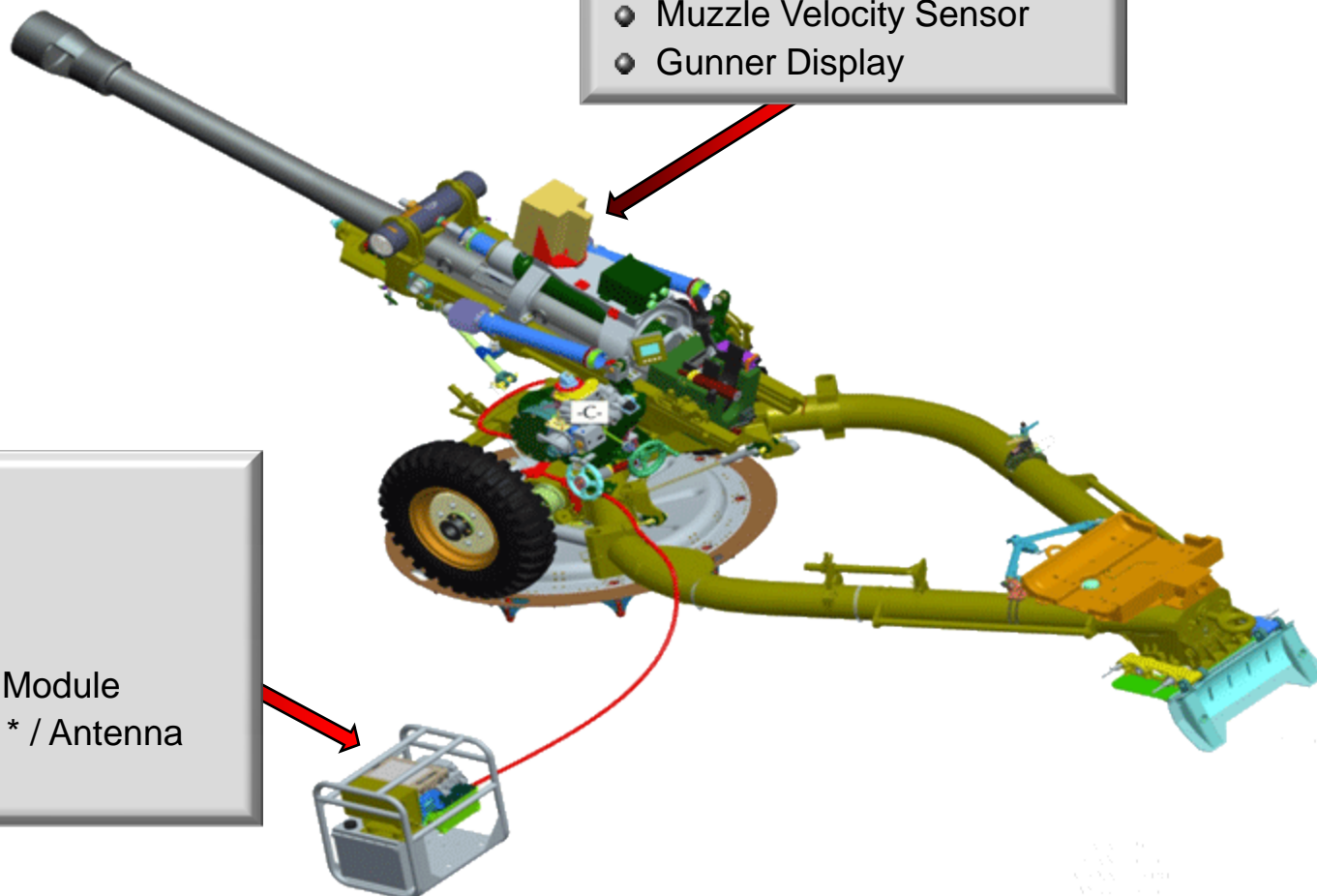


## On Carriage:

- ◆ Inertial Navigation Unit
- ◆ Muzzle Velocity Sensor
- ◆ Gunner Display

## Sled:

- ◆ iPIK
- ◆ Battery
- ◆ Data Power Hub
- ◆ Common Power Module
- ◆ Radio / Amplifier \* / Antenna
- ◆ FCC



## Outline

- **Fire Control Digitization** (*Presented by: Vic Galgano*)
  - Fire Control Functions
  - Indirect Fires Before Digitization
  - Digitized Systems and Their Advantages
- **Current and Future Trends** (*Presented by: Ralph Tillinghast*)
  - Smart Projectile Interface
  - The Move Toward Commonality
  - New Fire Control Technologies and Innovations



- Fire Control Interface with EPIAFS / PIK
- Munitions / Weapon Systems
  - Excalibur
    - Paladin (Portable Excalibur Fire Control System (PEFCS) was Interim Solution)
    - LW 155
    - M198 (Australian PEFCS)
  - PGK (Precision Guidance Kit)
    - Paladin
    - LW 155
  - Advanced Precision Mortar Munition Initiative (APMI)
    - MFCS-M M113
    - MFCS-M STRYKER
    - MFCS-D

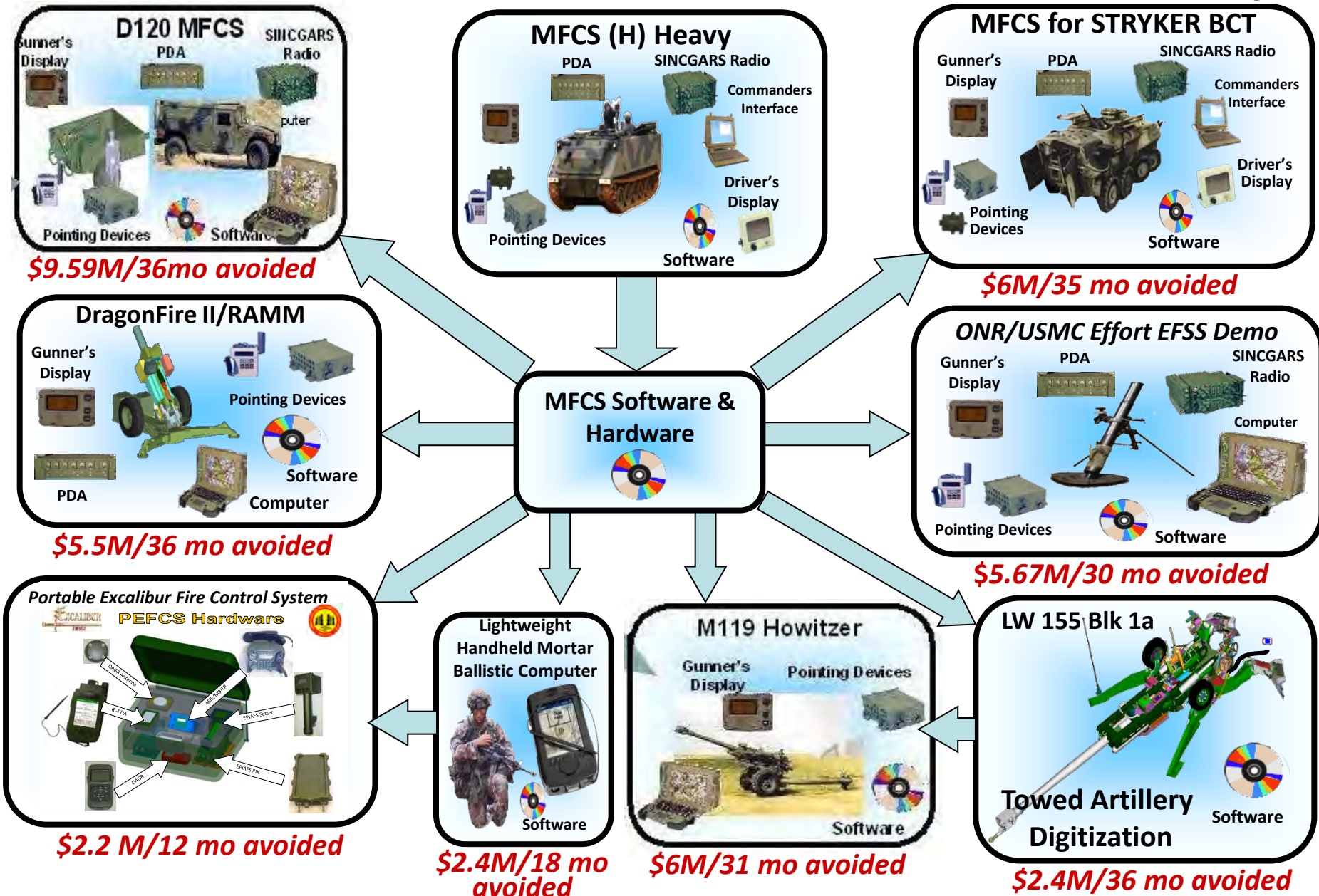


Memcam2.avi

- Numerous potential applications across US and NATO FC systems
- Technical Feasibility
  - Fire control functions largely independent of weapon requirements - their implementation varies
  - “Weapon-Specific” technical requirements are essentially the same and mainly affect HW integration
  - “Weapon-Independent” requirements such as network interfaces/protocols and situational awareness affect all platforms and influence software upgrades
- Opportunity for
  - Enhanced development and interoperability among Nations
  - Potential Future Joint System Development
  - Significant Schedule and Life Cycle Cost Savings



# Example of the Effectiveness of Commonality



NOTE: SOFTWARE DEVELOPMENT COSTS ONLY

# Long Term Vision



## Common Requirements

- ☐ System Management
- ☐ Communication: FBCB2 & FS Nets
- ☐ Technical Fire Control
- ☐ Data Management/Processing
- ☐ Projectile Interface (e.g. XM982, MRM)
- ☐ Soldier Machine Interface/Displays
- ☐ Hardware/Peripheral Interfaces
- ☐ Sensor Interfaces
- ☐ Weapon Positioning
- ☐ Autoregistration
- ☐ Navigation
- ☐ Embedded Training
- ☐ Maintenance

## Common Solution

- ☐ Maximum Use of Existing, proven HW & SW
- ☐ Facilitates Pre-planned HW & SW Upgrades
- ☐ Promotes HW & SW Commonality
- ☐ Reduces Development, Testing, Production, Training, Maintenance, O&S Costs



## Enhanced Products & Capabilities

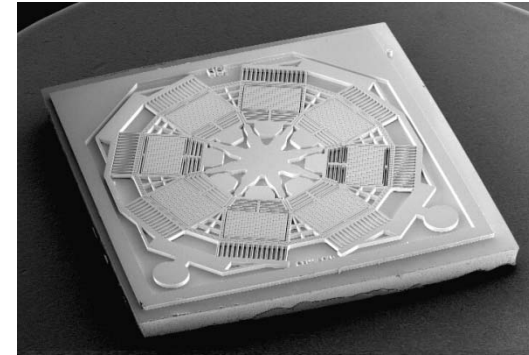
- |   |  |
|---|--|
| <input type="checkbox"/> Prototypes for Beta Fielding | <input type="checkbox"/> Technology Capabilities                       |
| <input type="checkbox"/> Responsiveness to User       | <input type="checkbox"/> Increased Reliability                         |
| <input type="checkbox"/> System Growth & Enhancements | <input type="checkbox"/> Common Maintenance                            |
| <input type="checkbox"/> Consistent Products          | <input type="checkbox"/> Lower Life Cycle Costs                        |
| <input type="checkbox"/> Concurrent Deployments       | <input type="checkbox"/> Operating Systems & Hardware Platform Porting |

**Structured Approach and Integration of Complementary Hardware & Software Fire Control Elements**





- MEMs Based Technologies
- Commercial Market Drivers
  - Automotive
  - Gaming (Wii)
  - Smart Phone / Tablets
- SBIR Work, AVAM-JWG
- Secure Wireless



MEMs Vibratory Gyroscopes Prof. Andrei Shkel, University of California at Irvine

- What does that drive?
  - Smaller
  - Lighter
  - Cheaper
  - More Accurate
  - Less Power
  - Increase in Operation



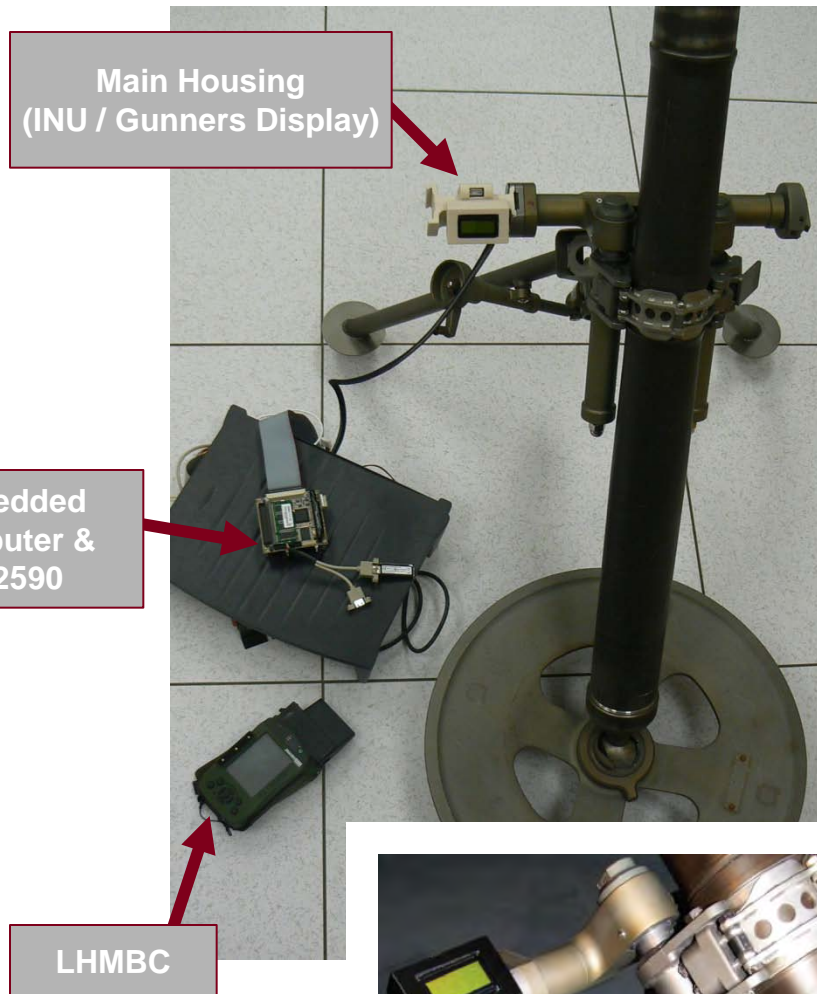
Fire Control In-A-Box

# Example of Future State: Wireless Universal Light Fire-Control (WULF)



WULF provides weapon pointing data from the LHMBC wirelessly to gunner. The Gunners display unit indicates the required gun shift information.

- Embedded Computer
- 3-4 mil Accuracy
- Target Battery Life: 24+ hours
- Report Delta Deflection and Elevation
- Adaptable to different wireless standards
- 60, 81 and 120mm compatible



## Contact Info:

Victor Galgano

Manager, Business Planning & Development  
Fire Control Systems & Technology  
US Army ARDEC, RDAR-WSF-B  
973.724.6021  
victor.galgano@us.army.mil

Ralph Tillinghast

Collaboration Innovation Lab, Director  
Fire Control Systems & Technology  
US Army ARDEC, RDAR-WSF-M  
973.724.2095  
ralph.tillinghast@us.army.mil

***Please visit the ARDEC Booth (#725) in the Exhibit Hall***



**International Legal Initiatives to Restrict  
Military Small Arms Ammunition**

W. Hays Parks\*

*Copyright 2010 by W. Hays Parks*

It is a pleasure to return to this meeting. My first opportunity to attend and address this outstanding assembly of industrial and military experts came twenty or so years ago. A colleague called. Familiar with my background and official portfolio, which includes law of war issues related to military small arms weapons systems, he briefed me on NDIA, advised it was holding its annual small arms section meeting at Aberdeen Proving Ground, then informed me that a representative from the International Committee of the Red Cross (ICRC) was addressing the group the following day.

I found this curious at best. The ICRC has a long and distinguished history with respect to protection of disaster relief and war victims, but it has neither a mandate nor the expertise to engage in issues related to the legality of military weapons. As it acknowledges:

“The ICRC has a legal mandate from the international community. That mandate has two sources:

“the 1949 Geneva Conventions, which task the ICRC with visiting prisoners, organizing relief operations, re-uniting separated families, and similar humanitarian activities during armed conflicts; [and]

“the Statutes of the International Red Cross and Red Crescent Movement, which encourage it to undertake similar work in situations of internal violence, where the Geneva Conventions do not apply.”

---

\* Senior Associate Deputy General Counsel, International Affairs Division, Office of General Counsel, US Department of Defense, 2003 to present; Special Assistant for Law of War Matters, Office of The Judge Advocate General of the Army, 1979-2003; Member, United States Delegation to Conferences for the United Nations Conventional Weapons Convention, 1978 to 2003 and 2006; Colonel, United States Marine Corps Reserve (Retired); Charles H. Stockton Chair of International Law, U.S. Naval War College, 1984-1985; Adjunct Faculty, George Washington School of Law, 1988 to 1997; Adjunct Faculty, Washington College of Law, American University, 1996 to present. Presentation made at National Defense Industrial Association Joint Armaments Conference, Dallas, Texas, May 18, 2010. Statements contained herein are the personal views of the author and may not necessarily reflect official positions of the Department of Defense or any other agency of the United States government.

A private Swiss corporation funded primarily by governments,<sup>1</sup> the ICRC mission is limited to assisting war victims in armed conflict, subject to the express consent of the parties to the conflict. In Geneva Convention terms, these are military wounded, sick, and shipwrecked; prisoners of war and retained personnel (that is, captured military medical personnel); and civilians detained in international or non-international armed conflict or in occupied territory in the case of the former. As its mandate states, the ICRC has no authority to assert itself with respect to issues related to the legality of military weapons and ammunition. By treaty law and historical precedent, these issues are the exclusive responsibility of governments. There is good reason for this, as it is governments that negotiate treaties, train and equip their military forces, fight wars, and bear the responsibility for ensuring their actions – including the legal review of new weapons – and military operations are carried out in accordance with their treaty obligations.

So it was with considerable interest that I sat in the Aberdeen NDIA session the following day to listen to an ICRC representative lecture attendees, some of whom are present today, on the terminal ballistics of contemporary military small arms ammunition and their alleged inconsistencies with the law of war. I found this all the more curious inasmuch as I had been the United States negotiator for military small arms ammunition at the 1978 to 1980 diplomatic conference that produced the 1980 Convention on Certain Conventional Weapons. The small caliber working group consisted of a grand total of five representatives – two from Sweden, which proposed new regulations, and three from the United States. No ICRC representative attended working group meetings. The conference – that is, the government representatives from more than eighty nations,

---

<sup>1</sup> The United States government is the ICRC's largest donor by a large margin, contributing \$257,000,000 in 2009. In contrast and for example, the United Kingdom contribution was \$88,947,382; France, \$17,116,000; Japan, \$29,333,000; Germany, \$19,909,000; Kuwait, \$6 342,008; and Saudi Arabia, \$221,113. Austerity measures announced by an official of the new British coalition government on May 26, 2010, indicated reductions in British government contributions to non-government organizations due to current economic conditions. The amount of U.S. Government donations is not Administration-unique; contributions during the Administration of President George W. Bush were on the same level as the 2009 contribution, which in all likelihood was approved prior to the inauguration of President Barack Obama. The U.S. contribution is an earmark inserted into the Department of State budget by a member (or members) of Congress without hearings or consideration by the Department of Defense, notwithstanding the ICRC's repeated venture into weapons issues. As one attendee observed following my presentation, arguably U.S. Government largesse through these automatic donations is financing ICRC actions beyond its mandate.

including all NATO members, the Soviet Union and its Warsaw Pact allies, and China, Japan, South Korea, Australia, the Philippines, Malaysia, Indonesia, and New Zealand, to name a few – agreed that wounding characteristics of modern military small arms weapons and ammunition did not provide a basis for a new small arms protocol. Yet here stood an ICRC representative lecturing conference attendees on the alleged evils of contemporary military small arms weapons and ammunition.

Before proceeding with this history, it is necessary to acknowledge what many see as an anomaly in the law of war. Under the law of war, military forces engaging enemy forces can, and historically have:

- Vaporize or eviscerate enemy combatants with a high-explosive bomb, a single artillery shell or intense bombardment, a satchel charge, or other modern-day equivalents;
- Cause an enemy combatant to become a quadriplegic with an anti-personnel mine or Claymore;
- Incinerate an enemy combatant with a flame thrower or napalm;
- Reduce enemy combatants to a “pink mist” inside a tank through the spalling effect of anti-armor munitions; or
- Kill an enemy combatant through multiple wounds from concentrated unit small arms fire or a single shot to the head or heart.

Yet the law of war prohibits the use of weapons that are calculated to cause “unnecessary suffering” or “superfluous injury” to enemy combatants, resulting in assertions by the ICRC and others that the diminutive 5.56x45mm projectile (whose inability to render a enemy combatants *hors de combat* increasingly is being realized in battlefield reports from the conflicts in Iraq and Afghanistan) are “illegal”, all the while maintaining silence with respect to, for example, improvised explosive devices indiscriminately employed by al Qaeda and the Taliban, resulting in far more severe injuries to combatants and civilians alike, or suicide bombs directed at civilians.

I acknowledge the obvious appearance of a contradiction between the severity of injury, including death, that other lawful weapons may inflict on combatants, and wounds caused by the 62-grain 5.56x45mm NATO SS-109 projectile. I deal with it regularly in

the legal review of new weapons and munitions. As strange as it may appear, the legal standard works. The problem is not the legal standard, but its distortion by the ICRC's flawed "effects-based" arguments in carrying out its political agenda.

To complete my opening story, I followed the ICRC representative, beginning by saying "Disregard everything this man just said." I explained the U.S. Department of Defense program for the legal review of new military weapons and ammunition. It is one of the oldest and regarded by most as the most comprehensive such program in existence. So I took exception to the ICRC stepping in to lecture this international audience of small arms experts, military and civilian, as to how its members should conduct business in an area in which the ICRC has neither a mandate nor experience or expertise.

The title of my presentation is "international legal initiatives to restrict military small arms ammunition". In order to gain an appreciation for the current effort, it is necessary to summarize past attempts. I will take a chronological approach to the relevant history, not only with respect to *what* but also *why* those attempts were made.

### **The 1899 Hague Peace Conference and its Expanding Bullet Declaration**

At the First Hague Peace Conference (1899), delegates adopted the Hague Declaration Concerning Expanding Bullets. It is brief, with two key points:

- "The Contracting Parties agree to abstain from the use of bullets which expand or flatten easily in the human body, such as bullets with a hard envelope which does not entirely cover the core or is pierced with incisions.
- "The present Declaration is only binding for the Contracting Parties in the case of a war between two or more of them."

The declaration was not without its faults and critics. It was apparent the Declaration was the product more of an expression of opposition by the German delegation to British operations in the Anglo-Boer War, then in progress, than offered for humanitarian reasons. Moreover, German testing used hunting ammunition in a rifle of different caliber rather than a British .303 Lee-Enfield and the Mk. III cartridge with its hollow-point (RL 9402) projectile.

This raises a point of history with respect to efforts to regulate or prohibit military small arms ammunition. Whenever there has been a challenge to the “legality” of military small arms ammunition, it has been for political and/or economic rather than humanitarian reasons as its proponents claimed.

While the greatest emphasis has been on the first paragraph of the 1899 Hague Declaration, for today’s discussion the second is more important. By its terms this declaration was an arms control agreement that applied only in international armed conflicts between governments that accepted it. As it turned out, these were few. In the 111 years since its adoption by the First Hague Peace Conference, only thirty-one nations (out of 194) have agreed to be bound by it; only four ratified it in the last 100 years. For law of war treaties, that is an underwhelming statistic. In contrast, the 1949 Geneva Conventions have been ratified by 194 nations.

The United States declined to ratify the 1899 Hague Declaration Concerning Expanding Bullets. In the course of the 1899 conference, the United States delegate for negotiating this declaration, Army Captain (later Brigadier General, and Army Chief of Ordnance, 1901-1918) William H. Crozier, offered two salient points:

The use of bullets which inflict uselessly cruel wounds, such as explosive bullets and, in general, every kind of bullets which exceed the limit necessary for putting a man immediately *hors de combat*, is forbidden.

Captain Crozier’s criteria for determining effectiveness and legality of military small arms ammunition has been the United States legal standard since he offered it in 1899. It is not “more lethal”, or offering “increased lethality”, or affording “greater stopping power”, focusing solely on terminal ballistics or, as the ICRC unsuccessfully argued ten years ago with its “effects-based” determination of legality. That standard was rejected in a peer review of medical and legal experts it hosted. Yet the ICRC continues to argue for it in its criticism of contemporary military small arms ammunition.

Second, Captain Crozier emphasized that in determining the legality of military small arms ammunition, one should consider the rationale or purpose for the bullet, such as military requirements (anti-personnel or anti-materiel, for example, or, in today’s terms, “blind-to-barriers”), as well as all aspects of the triad of military ammunition characteristics, that is, its interior ballistics, including (or perhaps especially) its



reliability to function, second, its exterior ballistics, such as its effective range and accuracy, and, finally, its terminal ballistics, that is, what it does when it strikes enemy combatants or materiel. The legitimacy of these factors, not merely its possible effects, such as terminal ballistics at close range, is critical military ammunition development and legal reviews of that ammunition.

Captain Crozier's second point is best illustrated by the change that began to occur in military rifle ammunition at the time of the First Hague Peace Conference. By 1910, round-nosed bullets had been withdrawn by France, Germany, Switzerland, the United Kingdom, the United States, and other nations in favor of Spitzer-tip projectiles. The latter were developed and acquired to meet military requirements for increased range and accuracy. For example, in 1905 Germany transitioned from its 7.9mm 226-grain M1888 (2,093 fps, with a range of 2,700 yards) to its 154-grain Spitzer (2,880 fps, 3,800 yards). It became apparent that terminal ballistics at closer ranges (up to 250 meters) likely included yaw and increased probability of fragmentation in soft tissue. Using Captain Crozier's formula, governments concluded the additional range and increased accuracy outweighed the marginal increase in injury to enemy combatants. Over the next century, other than Sweden's complaint about the M16 and its 5.56x45mm M193 projectile during and following the Viet Nam War, discussed *infra*, no government ever protested the consequences of use of Spitzer-tip projectiles. This was because their military value was acknowledged and their use was virtually universal.

In the century or more following the First Hague Peace Conference, governments relied upon full-metal jacketed ammunition in the main not out of a sense of legal obligation to the 1899 Hague Declaration (as indicated, most were not parties to it) but owing to interior ballistics, that is, the necessity for reliability in weapon functioning and feeding, particularly in machineguns.<sup>2</sup> Only in the last four decades have weapons been

---

<sup>2</sup> For the history of the 1899 Hague Declaration, see Alan Ogston, "Continental Criticism of English Rifle Bullets," *British Medical Journal* (March 25, 1899), at 752-757; "The Peace Conference and the Dum Dum Bullet," *British Medical Journal* (29 July 1899), at 278-281; and Colin Greenwood, "The Political Factors," *Gun Digest* 34 (1980), pp. 161-168. The .303 Mark IV is described in P. Labbett and P.J.F. Mead, *.303 inch* (1988), at 24-25. State practice with regard to acquisition of hollow point or expanding military rifle bullets has been limited due in primarily to its lack of reliability in weapon functioning. For example, the British Mark IV was not authorized for use in machineguns. Labbett and Mead, at 25.

developed to the point where some will function reliably with expanding ammunition. Further, no military requirement has been identified for expanding bullets in military operations on either a linear or a non-linear battlefield, whether in international or non-international (internal) armed conflict. The only identified requirement for expanding ammunition has been for military counter-terrorist units and domestic law enforcement – in each case, not to increase “stopping power” or “lethality”, but to minimize the likelihood of ricochet or over-penetration in order to reduce risk to innocent civilians or friendly force personnel.

At the same time, the history of wound ballistics revealed the previously-mentioned yaw and fragmentation phenomenon common to most military rifle projectiles. A leading official study of World War II and Korean War wounds commented:

There were no features present to distinguish the wounds produced by the Japanese rifle from those produced by the U.S. rifle ....

Common to all these cases and characteristics in the wound of the solid organs in the kidney, liver, and spleen was the widespread ‘shattering’ and fragmentation produced by the explosive effect of the missile in its passage.<sup>3</sup>

Thus military rifle bullet fragmentation in the body is not new. It has been common to almost all full metal jacketed military rifle projectiles for more than a century for obvious reasons. Velocity is necessary for range. The Spitzer-tip projectile is important for reduced body drag, enabling the projectile to retain velocity to for greater distances than its round-nosed predecessors. Because its center of gravity is slightly to the rear of the center of the projectile, a typical bullet that strikes the body at an angle will tend to yaw and turn 180° in the human body, continuing its path base forward. At closer ranges, if the bullet strikes the body at an angle, causing it to yaw, the velocity necessary

---

<sup>3</sup> Major James C. Beyer, MC, USA, ed, *Wound Ballistics* (1962), pp. 275-276, reporting on U.S. and Japanese casualties during Bougainville Campaign, February 15 to April 21, 1944. *See also* Colonel Martin S. Fackler, MC, USA, “Wounding patterns in military rifle bullets”, *International Defense Review* 59-64 (1/1989).

for its longer range capability will stress the jacket, likely resulting in projectile fragmentation.

### **The Swedish assault on the U/S. M16 rifle and its 5.56x45mm cartridge.**

As I indicated, the fragmentation phenomenon was common and well known prior to development of the AR-15 rifle and its 5.56x45mm cartridge in the 1960s. The controversy at the 1899 Hague Peace Conference was resurrected in part by hyperbole regarding the 5.56 caliber AR-15, a self-inflicted wound by Colt and proponents of its AR-15/M16. All within this audience undoubtedly have a reasonable familiarity with the M14 versus M16 rifle controversy of the early 1960s. It was two-fold: “Trashing” of the 7.62x51mm M14 by Colt and other proponents of the AR-15/M16, and exaggerated claims as to the “lethality” of its .22 caliber round. In his 2008 *The American Rifle: A Biography*, Alexander Rose observes:

The long-standing idea that the M14 was an inherently poor weapon, it seems, had its genesis in a corporate rival spinning the complex story of its development into an easy-to-understand conspiracy theory about reactionary government officials and military experts crushing innovation wheresoever it could be found.

The M14 has been vindicated through its return in substantial numbers to the Iraq and Afghanistan battlefields by the U.S. military and other nations, as well as continued military and law enforcement reliance on its 7.62x51mm cartridge for long-range precision shooting.

The exaggerated claims by Colt that did the greatest damage prior to the shift from the M14 to the Ar-15/M16. One commercial asserted:

Unsurpassed as a Sniper Rifle both accurate and lethal, at 500 yards the AR-15 makes a complete penetration of 10-gauge steel, or both sides of a steel helmet. On impact the *tumbling* action of the .223 caliber ammunition increases effectiveness. [emphasis provided]<sup>4</sup>

---

<sup>4</sup> R. Blake Stevens and Edward C. Ezell, *The Black Rifle: M16 Retrospective* (1987), p. 98, contains the Colt advertisement.

The hyperbole in the advertisement is easily disproved given the information we have today. The standard AR-15/M16 never had sniper rifle accuracy. As previously noted, bullets do not ‘tumble’. They may yaw and rotate 180 degrees within the body, but the standard definition of “tumble” suggests turning end-over-end through a full 360 degrees. This rarely happens. Since the Viet Nam War up to today the word ‘tumble’ has been used pejoratively by those who wish to ban high-velocity, Spitzer-tip military rifle projectiles, ignoring history and arguing (thus far without success) that they are tantamount to the “dum-dum” bullets prohibited by the 1899 Hague Declaration.<sup>5</sup> Thus “tumbling” is not only an inaccurate description of terminal ballistics of military rifle projectiles but a term the military small arms industry uses at its peril.

During and immediately following the Viet Nam War, critics of U.S. involvement in that conflict attacked many of the weapons employed, including the M16 rifle. As a result of that criticism, a United Nations-sponsored Diplomatic Conference met in Geneva between 1978 and 1980. Sweden proposed a protocol to update the 1899 Hague Declaration. As noted in my opening comments, governments not only expressed significantly less interest in the small caliber issue than others under consideration at the conference, but at the end of the day saw no reason to support the Swedish proposal calling for a small-caliber protocol. To the overwhelming majority, the wounding effect of military small-caliber weapons and ammunition – particularly 22 caliber ammunition, significantly smaller than the .30 caliber predecessors employed throughout the Twentieth Century wars and still in use -- did not rise to the level of being an issue worthy of serious consideration, much less new regulation.

Subsequently the reasons for the proposal by Sweden became apparent:

- First was Sweden’s opposition to United States’ support for the Government of the Republic of Viet Nam against the war being waged against it by the Democratic Republic of Viet Nam. Although that conflict had ended, the U.S. M16 rifle in part was seen as symbolic of that war and one of many weapons criticized by Sweden during that conflict.

---

<sup>5</sup> See, for example, Stockholm International Peace Research Institute, *The Law of War and Dubious Weapons* 68-70 (1976), and *Anti-Personnel Weapons* 66-67 (1978).

- Second, exaggerated terminal ballistics claims by Colt to sell their weapons to the U.S. military provided Sweden and other perpetual U.S. critics political “ammunition” to challenge the legality of the U.S. 5.56x45mm cartridge and weapons systems, alleging “inhumane” wounding.<sup>6</sup>
- Finally, the Swedish arms industry had its 4.5x26R MKR assault rifle under belated development for the on-going NATO second rifle caliber competition. Realizing the U.S. 5.56x45mm caliber and other competing cartridges (the Belgian 5.56x45 SS-109, French 5.56x45mm steel case with M-193-type projectile, Netherlands M-193 type, British 4.85mm and German 4.7mm)<sup>7</sup> had a head start in consideration, the 5.56 “legality” issue was intended to slow the second rifle caliber decision as Sweden continued development of its candidate. It became all for naught when NATO adopted the 5.56x45mm (Belgian SS-109) as its second caliber on October 28, 1980.

The Swedish challenge to the 5.56x45mm cartridge, while unsuccessful, did precipitate significant international discussion. Sweden hosted several meetings of international ballistics experts during and following the 1978-1980 conference that in turn brought about its own hyperbole. For example, at the Fourth International Wound Ballistics Symposium, held in Göteborg in September 1981, the Fabrique Nationale representative asserted that its SS-109 projectile, recently adopted by NATO, had been developed in order to respect “the humanitarian recommendations of the United Nations” and “to provide the utilizer [that is, the soldier] a system that complies at best with both the tactical and humanitarian requirements”, suggesting incorrectly that the SS-109

---

<sup>6</sup> This allegation was hypocritical. Testing of the Swedish 7.62x51 ball round (equivalent to the NATO standard round of that caliber) revealed that its terminal ballistics were substantially more severe than that of the 7.62x51mm U.S. M80 ball, let alone the U.S. 5.56 M193 the Government of Sweden criticized. Fackler, *supra* n. 3, page 64.

<sup>7</sup> Edward C. Ezell, *The Great Rifle Controversy* (1984), page 268.



resulted in more humane wounds – an oxymoron, to say the least – than its M193 predecessor.<sup>8</sup>

### **The Swiss proposals for new military small arms regulation, 1995-2002**

The small arms debate quietly went away for fifteen years as NATO nations and others adopted 5.56x45mm weapon systems. It reappeared in 1995 at the first review conference for the 1980 Conventional Weapons Convention, where Switzerland proposed a new protocol for small caliber weapons. Its proposal contained nothing that had not been thoroughly considered at the original conference in its plenary and/or working group sessions.

Its proposal was less humanitarian than economic: In 1989, Switzerland completed construction on its underground, state-of-the-art Low Noise Ballistic Ranges at Thun. The adage “timing is everything” is appropriate, as their completion coincided with the end of the Cold War. Thereafter Switzerland, like many nations, began to reduce its military infrastructure, including its industry and bases. Facing the Swiss equivalent of the U.S. Defense Base Closure and Realignment Commission (BRAC), the Swiss Ministry of Defense persuaded its Ministry of Foreign Affairs to put forward its proposal in order to keep the Low Noise Ballistic Ranges open, and for other economic reasons.<sup>9</sup> When that did not succeed at the first review conference, Switzerland proceeded in 1998 to host four annual meetings of experts on wound ballistics in anticipation of the Conventional Weapons Convention’s second review conference in

---

<sup>8</sup> C. de Veth, “Development of the New Second NATO Calibre: The “5.56” with the SS109 Projectile”, *Acta Chirurgica Scandinavica* (Supplement 508) 129-133 (1982). As the 1978-1980 conference did not conclude with adoption of “humanitarian recommendations” with respect to small arms, my comments in response to Mr. de Veth’s are at pages 133-134. Wound ballistics testing of the SS-109 revealed that its terminal ballistics did not differ from its predecessor, the M193. Fackler, *supra* n. 3, pp. 61-62.

<sup>9</sup> The federal ammunition manufacturing facilities at Thun were to be privatized, for example, generating a requirement to develop military rifle cartridges it could argue were “more humane” in order to compete with other ammunition manufacturers. Thus in 1995, the Thun and Altdorf ammunition factories became Schweizerische Munitionsfabrik (SM), the first step in its privatization. In 2002, the Swiss RUAG absorbed the small arms ammunition sector of Dynamit Nobel, Germany, functioning as RUAG Ammotec.

The ICRC was an active participant in and advocate for the Swiss initiative until it was suggested that its support for Swiss political and military purposes was inconsistent with its basic principle of neutrality and its humanitarian mandate – the ICRC has never acknowledged the “legality” of any weapon, for example. It quietly withdrew from its overt support for the Swiss proposal for the time being, but as will be shown *infra*, fn. 13, reverted to its previous overt supporting position to support the agenda of the Government of Switzerland, and vice-versa.

2001. It was no more successful at the 2001 review conference and, at a substantially-reduced meeting of experts in Därligen in 2002, the Swiss Ministry of Foreign Affairs announced it would no longer fund the Ministry of Defense's effort to keep open the Low Noise Ballistic Ranges.

At the 2001 Thun Wound Ballistics Conference, Sir Christopher J. Greenwood CMG QC, a leading international law professor, and a member (Justice) of the International Court of Justice since 2009, responding to an invitation from the Government of Switzerland to offer a keynote speech on the legal status of the 1899 Hague Declaration on Expanding Bullets, concluded that the 1899 Declaration was not customary international law, that is, it was not binding on governments that had not become parties to it. Moreover, he suggested a test similar to that offered by Captain Crozier in 1899, balancing military requirements against injury to targeted enemy combatants rather than upon a prohibition based solely on terminal ballistics.<sup>10</sup> He expressed the view that in determining the legality of military small arms ammunition, terminal ballistics is not the only consideration:

It is also necessary to look at the circumstances in which the weapon is to be used today.... Many of the combat operations of today are closer to counter-terrorist operations<sup>11</sup> than the set-piece battles of 1868 or even 1939-1945. In looking at the military value of different types of weapons and ammunition, in such operations, it is particularly important to consider not only their use at longer range, but also their importance and effects in close combat in an urban setting.

Professor Greenwood viewed the two criteria for determining legality of small arms ammunition as the prohibition on superfluous injury and the law of war principle of distinction. A third is military necessity. He regarded the protection afforded civilians as more important than the prohibition on superfluous injury:

The protection of combatants from "unnecessary suffering" is clearly a significant part of international law, but the protection of people who are not combatants at all is surely of far greater significance. It is possible to envisage a weapon which causes a more serious injury to the combatant than those caused by other equivalent weapons available on the market, but which has the advantage of being more precise and, therefore, capable of being used in a more discriminating fashion.

Moreover, there are circumstances, particularly in street warfare and in counter terrorist operations where it may be necessary to make a trade, in effect, between the principle of the protection of civilian life and the principle of "unnecessary suffering" to combatants.

---

<sup>10</sup> Sir Christopher J. Greenwood CMG QC, "Legal Aspects of Current Regulations", Documentation: Third International Workshop on Wound Ballistics, Thun, 28-29 March 2001, published by the General Staff of the Swiss Armed Forces, Global Arms Control and Disarmament section..

<sup>11</sup> It is noted that Sir Christopher's keynote address was six months prior to the September 11, 2001, al Qaeda attack on the World Trade Center in New York City and on the Pentagon, using hijacked airliners.

What I would like to suggest is that where that trade has to be made – and I accept that it is not one which has to be made in all, or even most types of combat – one cannot regard suffering as unnecessary if it is to be inflicted for the purpose of protecting the civilian population. In other words, if the civilian population’s protection is enhanced by the use of a particular weapon, then the adverse effects of that weapon on combatants cannot properly be regarded as unnecessary.<sup>12</sup>

Professor Greenwood’s analysis emphasized three factors in determining small arms legality – design, intent, and effect (distinction vis-à-vis superfluous injury).

Jean-Phillippe Lavoyer, the ICRC Legal Adviser, and Dominique Loyer, ICRC Technical Adviser, were registered participants at the conference and/or present for Professor Greenwood’s keynote speech.

This point is important for the current issue, as in 2005 the ICRC published its purportedly comprehensive study of what constitutes customary international law.<sup>13</sup> Its conclusions have drawn much criticism, not only from the General Counsel, Department of Defense, and the Legal Adviser, Department of State,<sup>14</sup> but also from the prestigious British Institute of International and Comparative Law,<sup>15</sup> among others.<sup>16</sup> The flawed ICRC conclusion relative to the 1899 Hague Declaration that it is “customary law applicable in both international and non-international armed conflicts”, aspirational rather than authoritative, is not the result of credible scholarship and has been the object of challenge given the declaration’s limited membership and the fact that it expressly limits applicability only to armed conflicts between nations that had ratified it.<sup>17</sup> Of equal

---

<sup>12</sup> Greenwood, *supra* n. 10, at 17-18.

<sup>13</sup> ICRC, *Customary International Humanitarian Law* (Jean-Marie Henckaerts and Louise Doswald-Beck, eds.). The ICRC campaign began earlier. See Robin Coupland and Dominique Loyer, “The 1899 Hague Declaration concerning expanding bullets: A treaty effective for more than 100 years faces complex contemporary issues”, 849 *International Review of the Red Cross* 135 (2003).

<sup>14</sup> Joint letter of John B. Bellinger III, Department of State :Legal Adviser, and William J. Haynes II, General Counsel, Department of Defense, to ICRC President Jakob Kellenberger (March 8, 2007).

<sup>15</sup> *Perspectives on the ICRC Study on Customary International Humanitarian Law* (Elizabeth Wilmshurst and Susan Breau, eds., 2007).

<sup>16</sup> See, e.g., David Turns, “Weapons in the ICRC Study on Customary International Law”, 11 JCSL (2006), pp. 201 at p. 233; and William H. Boothby, WEAPONS AND THE LAW OF ARMED CONFLICT 144-150, 326 (2009). The forthcoming Department of Defense Law of War Manual expressly rejects the ICRC assertion regarding the customary law status of the 1899 Hague Declaration.

interest is the fact that in addition to failing to cite any authorities for its conclusion, it (in all likelihood intentionally, given that it contradicts the assertion the ICRC made) failed to cite the conclusions of Justice Greenwood to the contrary, notwithstanding the ICRC presence at Justice Greenwood's speech.

If I may return to the earlier Aberdeen confrontation with the ICRC representative, it was the first signal of the post-Cold War decision by the ICRC to step beyond its mandate and begin attacks on military weapons and, in the main, Western nations' weapons.

The 2005 ICRC assertion regarding the 1899 Hague Declaration's legal status was the next step in its effort not merely to advise governments with regard to the Geneva Conventions but to *make* law, part of the effort by non-government organizations such as the ICRC to "break" the historic monopoly of governments with respect to creating international law. By asserting that the 1899 Hague Declaration is customary international law, the ICRC could proceed to its next major step.<sup>18</sup>

### **The International Criminal Court proposal**

The International Criminal Court, established in 1998,<sup>19</sup> will hold its review conference in Kampala from May 31 to June 11, 2010. Among the proposed new

---

<sup>17</sup> Boothby, *id.*, and George H. Aldrich, *Customary International Humanitarian Law – An Interpretation on behalf of the International Committee of the Red Cross*, 76 *British Yearbook of International Law* 503 (2005), in which Ambassador Aldrich offered the following observation: "Given the almost inevitable involvement of [domestic] law enforcement agencies in non-international armed conflicts and the potential aspects of some non-international armed conflicts, one wonders how this inconsistency [that is, the ICRC's assertion] will be resolved. The commentary to the ICRC study offers no answers." (*id.*, 520).

<sup>18</sup> In the interim, with the assistance of the Swiss Low-Noise Ballistics Range staff, in June 2008 the ICRC published *Wound Ballistics: An Introduction for Health, Legal, Forensic, Military and Law Enforcement Professionals*. It included a DVD. In addition to factual errors, the material contains misleading information. For example, shots were fired into soap rather than the NATO standard 10% ballistic gel, thereby suggesting to uninformed lay personnel that the temporary cavity is the permanent cavity, intentionally exaggerating terminal ballistics. The publication also confirms that the ICRC agenda is inextricably tied to the Government of Switzerland's economic, political, and military interests rather than the "humanitarian" principles it asserts.

<sup>19</sup> President Clinton signed the Rome Statute on behalf of the United States on December 31, 2000, but declined to submit it to the Senate for its Constitutional advice and consent to ratification. On May 6, 2002, the Administration of President George W. Bush announced that the United States did not intend to take steps to become a party to the Rome Statute.

offenses is the following, sponsored by Austria, Argentina, Belgium, Bolivia, Bulgaria, Burundi, Cambodia, Cyprus, Germany, Ireland, Latvia, Lithuania, Luxembourg, Mauritius, Mexico, Romania, Samoa, Slovenia and Switzerland,<sup>20</sup> but generally referred to as “the Belgium Amendment”:

xix) Employing bullets which expand or flatten easily in the human body, such as bullets with a hard envelope which does not entirely cover the core or is pierced with incisions.

Justification. The use of the weapons listed in this draft amendment is already incriminated by article 8, paragraph 2, b), xvii) to xix) of the Statute in case of an international armed conflict. This amendment extends the jurisdiction of the Court for these crimes in case of an armed conflict not of an international character.

This effort merits explanation. A protocol to the Conventional Weapons Convention requires consensus. As stated, small arms initiatives by Sweden and Switzerland received no support from other governments in the Conventional Weapons Convention process. In contrast, revisions to the Statute for the International Criminal Court can be adopted by a vote of two-thirds majority. Further, whereas many delegates to Conventional Weapons Convention review conferences are experienced military officers and/or weapons experts, few delegates to International Criminal Court review are military officers, much less technical experts, on such esoteric topics as military small arms ammunition and wound ballistics.

The ICRC assertion that the 1899 Hague Declaration is customary international law was a necessary step in seeking to create jurisdiction before the International Criminal Court (ICC). Creation of ICC jurisdiction for alleged violations of the 1899 Hague Declaration in international and non-international armed conflicts is a “back door” approach to legally binding 163 governments who for 111 years (or since their establishment as independent sovereign States) have declined to be bound by it. The ICRC effort (through the Belgium amendment) in all likelihood is designed to create a template for forcing other and perhaps all law of war treaties upon nations not a party to them.

---

<sup>20</sup> The ICRC is not named. Only States Parties to the ICC may sponsor amendments.



Application of the 1899 Hague Declaration to non-international armed conflicts would have little effect on conventional armed force operations. Potentially it could have significant negative effects on domestic law enforcement and military counter-terrorist operations. The wars in Iraq and Afghanistan today generally are regarded as non-international armed conflicts. Although the United States experienced the largest non-international armed conflict in its Civil War (1861-1865), the likelihood of a non-international armed conflict within the United States today is remote. But the safety of U.S. federal law enforcement and military counter-terrorist personnel engaged in foreign internal defense and other missions could be endangered for a different reason.

While the 1899 Hague definition of expanding bullets would not hamper conventional force operations, in its 2005 customary law study, the ICRC broadened the treaty definition, placing emphasis on the definition in the current German law of war manual:

projectiles of a nature to burst or deform while penetrating the human body, to tumble (*sic.*) early in the human body or to cause shock waves leading to extensive tissue damage or even lethal shock.<sup>21</sup>

Had it been in effect, this broad definition would have prohibited virtually all military rifle ammunition used in armed conflicts throughout the Twentieth Century, including Germany, and all existing military rifle ammunition, including the NATO standard SS-109 . Virtually any military rifle projectile fired at an enemy combatant at close range is likely to deform while penetrating the human body, or yaw if it strikes at an angle. The temporary cavity formed as the projectile passes into the body generally has no injurious effect unless it travels close to less resilient organs of a target shot at close range, where velocity is high.

Ironically two of the nations most likely to be indicted for violation of this offense are Belgium, inventor of the SS-109 adopted by NATO as its standard 5.56x45mm cartridge, and Germany. A 1989 *International Defense Review* article by Colonel Martin L. Fackler, MC, USA, on wounding patterns of military bullets, contains an x-ray photograph of the 7.62x51mm U.S. M80 and the German version of the same NATO

---

<sup>21</sup> ICRC *Customary International Humanitarian Law*, *supra* note 7, Vol. I, page 271, citing HUMANITARIAN LAW IN ARMED CONFLICTS MANUAL, DSK VV207320067, ¶ 407 (1994).

standard projectile. The German projectile has a thinner jacket than its U.S. counterpart. After firing each into the NATO-accepted ten per cent ballistic gel, the U.S. M80 is intact; the German projectile has deformed and fragmented.<sup>22</sup> Unless nations sponsoring the Belgian Amendment ensure its consistency with longstanding State practice, it may well be that the first International Criminal Court indictments will or should be made against sponsoring governments who succumbed to politically correct but historically and legally flawed arguments for this statute amendment.<sup>23</sup>

The irony and error of the ICRC effort to create a criminal offense for actions that nations have regarded as lawful for more than a century is best illustrated by the example of certain disparities with respect to the 5.56x45mm NATO standard SS-109. While identified as a “standard”, nonetheless great latitude is provided individual governments with respect to the final product, such as to bullet jacket material and jacket thickness – as was shown with respect to the U.S. and German NATO 7.62x51mm projectiles.

As I illustrated during my formal presentation, sectioned 5.56x45 projectiles from different NATO nations revealed slight differences. There are legitimate reasons for these differences, not the least of which is to ensure compatibility with the weapon systems in which the ammunition will be employed. The current United Kingdom has a thicker jacket than its NATO counterparts, for example. This has resulted in less yaw and virtually no fragmentation. From the standpoint of the ICRC argument, this would be required legally because the British projectile arguably is “more humane”. The irony is that the through-and-through wound commonly resulting from the British bullet consistently has failed to render the targeted enemy *hors de combat*, necessitating a British soldier shooting his target ten or more times before he ceases to be a threat. Somehow the “humanity” of shooting an enemy soldier ten or more times to render him *hors de combat* vis-à-vis a single projectile that can effectively and predictably incapacitate him is incongruous even when viewed in its most favorable light.

---

<sup>22</sup> Fackler, *supra* n. 1, pp. 63, 64.

<sup>23</sup> This would include not only Germany (for its fragmenting 7.62x51mm projectile) and Belgium (for its SS-109), but Switzerland, for, among others, the RUAG Swiss P Styx Action (“rapid action hollow point”) marketed at this conference for domestic law enforcement and counter-terrorist operations. The Belgium Amendment is inherently flawed in that it fails to reflect critical elements for other ICC crimes, such as a requirement for knowledge and *mens rea*.

In closing, permit me to offer an ancillary word of caution. This concerns the temptation some may have to “tweak” the 5.56x45mm ball round to enhance anti-personnel use (that is, terminal ballistics) or, as some say, to make it “more lethal”. If some feel that necessary, perhaps it is time to acknowledge the 5.56x45 caliber is a substandard performer rather than provide “ammunition” (a play on words) to bolster the arguments of those who wish more draconian rules.

Thank you.

# 2010 Joint Armaments Conference, Exhibition & Firing Demonstration

## 2010 Update to ITAR Export Controls



- Electronic TAA Submissions
- Proposed changes to 22 CFR 125.4(b)(9): Export of technical data
- Proposed changes to CFR 126.4: shipping for USG
- Proposed changes to 22 CFR 129: Broker registration
- ITAR registration for small businesses
- Review of the Basics





# Electronic Submission of Agreements

- Use of the D-Trade 2 system for submitting, reviewing, and approving agreement proposals.
- Use of the DSP-5 tool as the primary instrument to submit required documentation
- Only new agreements and re-baselined agreements may be submitted via the D-Trade 2 system.
- Applicants are not authorized to submit an proposed amendment to a previously approved paper agreement via electronic means.
- Electronic submission ONLY after September 2, 2010

[http://www.pmddtc.state.gov/licensing/documents/WebNotice\\_ElectronicAgreements.pdf](http://www.pmddtc.state.gov/licensing/documents/WebNotice_ElectronicAgreements.pdf)



# Proposed changes to 22 CFR 125.4

## Export of technical data abroad

### 22 CFR 125.4: Exemptions of General Applicability

#### Proposed changes to 22 CFR 154.4 (b)(9):

(9) Technical data, including classified information, and regardless of media or format, sent or taken by a U.S. person who is an employee of a U.S. corporation or a U.S. Government agency to a U.S. person employed by that corporation overseas outside the United States or to a U.S. Government agency outside the United States. This exemption is subject to the limitations of §125.1(b) and may be used only if:

- (i) The technical data is to be used ~~overseas~~ outside the United States solely by U.S. persons;
- (ii) If the U.S. person ~~overseas~~ outside the United States is an employee of the U.S. Government or is directly employed by the U.S. corporation and not by a foreign subsidiary; and
- (iii) The classified information is sent ~~overseas~~ outside the United States in accordance with the requirements of the Department of Defense National Industrial Security Program Operating Manual (unless such requirements are in direct conflict with guidance provided by the Directorate of Defense Trade Controls, in which case the latter guidance must be followed).



# Proposed changes to 22 CFR 125.4

## Export of technical data abroad

### 22 CFR 125.4: Exemptions of General Applicability

Result of proposed changes to 22 CFR 154.4 (b)(9):

Explicit approval to hand carry technical data, regardless of media or format outside the United States when:

- The possessor is a U.S. citizen,
- employed by a U.S. Corporation or U.S. Government, and
- the data is delivered to a U.S. person employed by a U.S. Corporation or U.S. Government.

Final rule has NOT been published – continue to follow current 125.4 guidance



Proposed changes to 22 CFR 126.4  
Shipments by or for United States Government agencies.

Current restrictions within 22 CFR 126.4:

- Must have Government Bill of Lading
- ALL aspects of transport (export, carriage, and delivery abroad) must be conducted by US Government Agency.



## Proposed changes to 22 CFR 126.4

Shipments by or for United States Government agencies.

Result of proposed changes to 22 CFR 126.4 (a) and (b):

- Easier to ship
- Exemption applies to any USG transaction
- No longer reliant upon U.S. Government for transport.





## Proposed changes to 22 CFR 129 REGISTRATION AND LICENSING OF BROKERS

*Broker:* any person who acts as an agent for others in negotiating or arranging contracts, purchases, sales or transfers of defense articles or defense services in return for a fee, commission, or other consideration.

*Brokering activities:* ...includes the financing, transportation, freight forwarding, or taking of any other action that facilitates the manufacture, export, or import of a defense article or defense service, irrespective of its origin.



# Proposed changes to 22 CFR 129

## REGISTRATION AND LICENSING OF BROKERS

Under the proposed new definition, a broker is a person that:

(1) acts as an intermediary

(2) to facilitate the manufacture, export, re-export, import, transfer or retransfer of a defense article or defense service.



# Proposed changes to 22 CFR 129 REGISTRATION AND LICENSING OF BROKERS

## Proposed Changes:

- Exclusion of USG employees, working in an official capacity
- Foreign persons conducting brokering activity
- Bona-fide, full time employees
- Agent representing DDTC registered company's defense articles or services ONLY
- Eliminate prior approval requirement under 22 CFR 126.8



# ***BASICS OF EXPORT CONTROLS***



# The Case of Professor John Roth

- Retired professor convicted of arms export violations in September 2008 and sentenced to four years imprisonment in July 2009
- ***“Today’s guilty verdict should serve as a warning to anyone who knowingly discloses restricted U.S. military data to foreign nationals.”***

-Acting AAG for National Security, DOJ press release Sept. 3, 2008

- ***“Roth was guilty, at most, of being ignorant of the law, believing it only applied to the finished product ... and not research.”***

- Knoxville News Sentinal, July 2, 2009, referring to defense attorney’s argument





# Basics For ITAR Compliance

- Registration: Any U.S. party engaging in manufacture and/or export of defense articles, or furnishing defense services must register with DDTC. **Export activity is NOT required.**
- Licensing: Exporting a defense article, technical data, or defense service requires a license from DDTC.
- Agreements: Foreign manufacture or warehousing of defense articles, or the performance of defense services



# What Is An Export?

- Sending or taking any **item** governed by the U.S. Munitions List out of the United States to a foreign destination **in any manner**
- Item includes unclassified as well as classified:
  - Commodity
  - Software
  - Technology
  - Technical information
  - Blueprints
  - Design plans



# What Is An Export (cont.)?

- Permanent or temporary
- Gift
- To wholly-owned U.S. subsidiary in foreign country
- Disclosing (oral or visual) or transferring a defense article or technical data to a foreign person
- Technical assistance (*e.g.* manufacturing know-how, technical training, etc.)
- Performance of a defense service on behalf of or for the benefit of a foreign person



# What Is An Export (Cont.)?

- Doesn't have to be made in the U.S.
  - Exported, transmitted or transshipped through U.S.
  - Returned from the U.S. to the country of origin
- Can occur in the U.S. (Deemed Export Rule)
  - Release of technology or source code to foreign national in the U.S. (includes embassies)
  - Constitutes an export to the home country of the foreign national



# How Exports Occur

- Mail
- Hand carry on travel
- Facsimile
- Email
- Upload to, or download from an internet site
- Telephone conversation
- Oral presentation
- Meetings with foreign national
- Plant tours
- Joint development projects
- Joint marketing projects
- Webinars





# Resources

- Commerce Department: <http://www.bis.doc.gov/>
- State Department: <http://www.pmddtc.state.gov/>
- Treasury Department OFAC:  
<http://www.ustreas.gov/offices/enforcement/ofac/>
- U.S. Gov't Export Portal: <http://www.export.gov>





ITAR is like a 12 step program: First comes anger, followed by denial, bargaining, depression, acceptance, and eventually DDTC registration.

- Senior DDTC Official, April 26, 2010



# Jason M. Wong, Attorney at Law



Hurricane Butterfly Research  
Import, Export and Manufacturing

Jason@HurricaneButterflyResearch.com  
253-414-6066



Firearms Law Group  
Legal Services to the Firearms Industry

jmwong@FirearmsLawGroup.com  
253-272-4700





# Joint Non-Lethal Weapons Program (JNLWP) Update for the Joint Armaments Conference 18 May 2010



**Kevin Swenson**  
Acquisition Division Chief



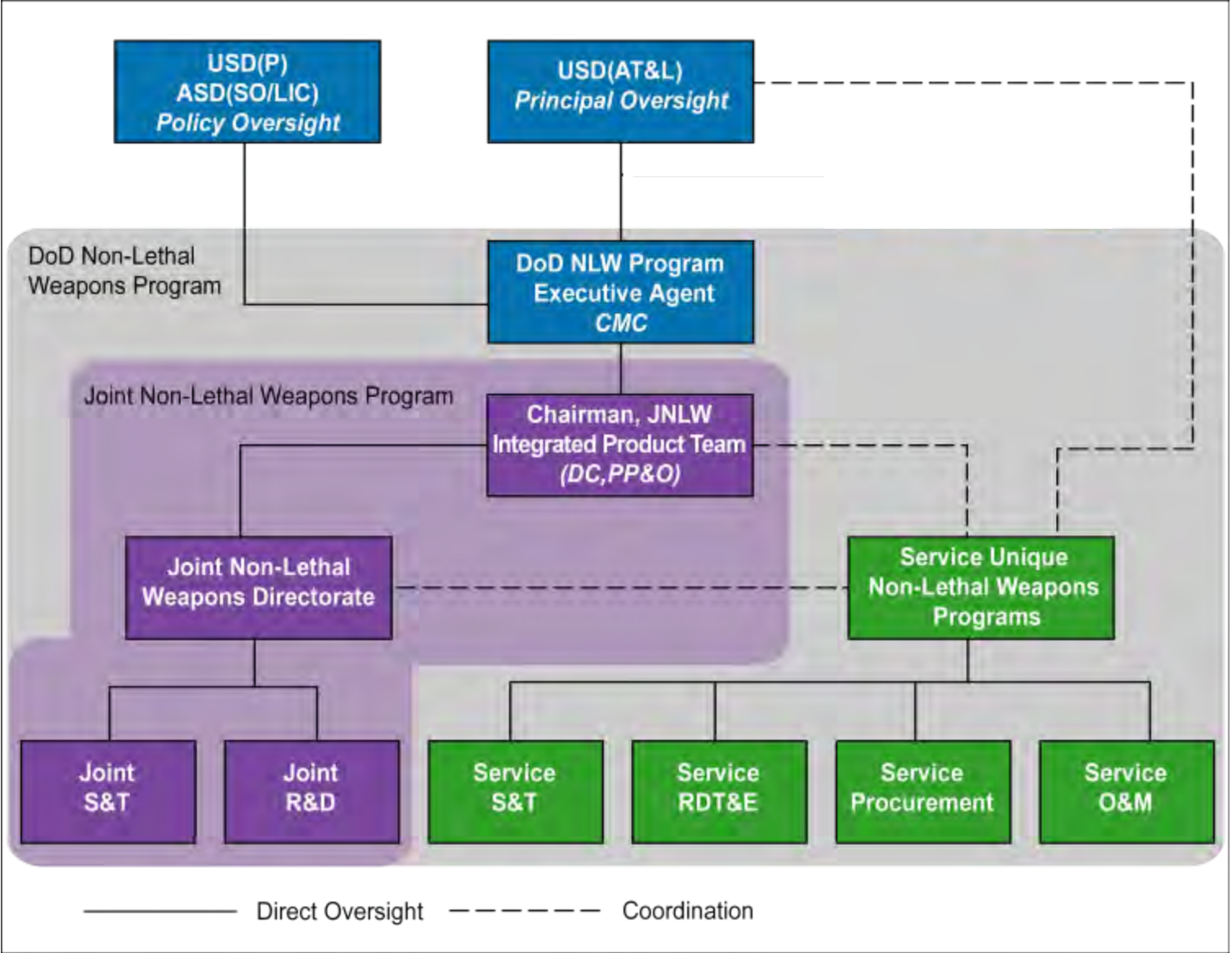
**Joint Non-Lethal Weapons Directorate**

3097 Range Road  
Quantico, Virginia 22134  
<https://www.jnlwp.com>  
kevin.swenson@usmc.mil

Telephone: DSN 378-0906  
Commercial: (703) 432-0906  
FAX: DSN 278 or (703) 784-3178  
Classified FAX: DSN 278-9896



# DoD Non-Lethal Weapons Program Management Structure







# Non-Lethal Weapons & Munitions in Use

## Counter-Personnel Capability Gaps



Optical Distractors



X-26 Taser



Modular Crowd  
Control Munitions



66mm Vehicle  
Launched NL  
Grenades



Flash Bang Grenades



Stingball Grenades &  
Launch Cups



Pen Flares



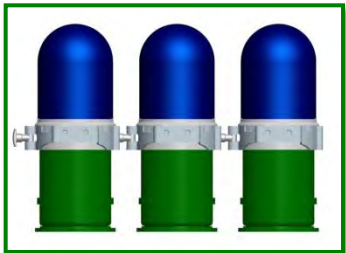
Acoustic Hailing  
Devices



# NLW & Munitions Developmental Efforts

## Counter-Personnel Capability Gaps

Suppress, Move and / or Deny Individuals / 1-150 Meters



**MK19 NL  
Munitioin**

**USA Lead  
MSC – 2QFY13**



**Improved  
Flash  
Bang  
Grenade**

**SOCOM Lead  
MSC – 3QFY13**

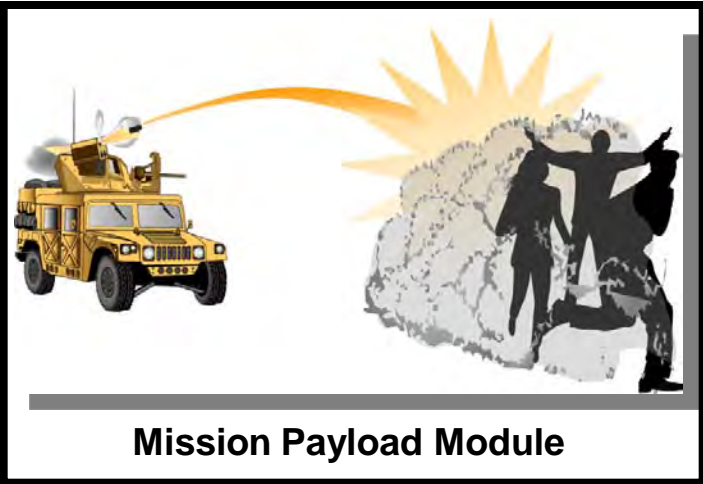


# NLW & Munitions Current Acquisition Programs

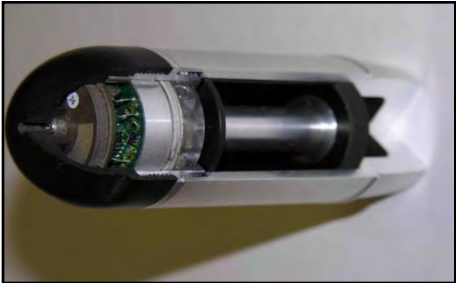


## Counter-Personnel Capability Gaps

Suppress, Move and / or Deny Individuals / 100-300 Meters



USMC Lead  
Milestone C:  
1QFY15



USA Lead  
Milestone C:  
2QFY12

Airburst NL Munition



# Joint Integration Program (JIP)



## DESCRIPTION:

The JIP is a forum established to coordinate a comprehensive program that maintains state-of-the-art non-lethal capability sets (NLCS) for each Service through product demonstrations, sharing lessons learned, and evaluating commercial off-the-shelf (COTS) products for potential inclusion into Service NLCS

## FY10 EFFORTS:

- NL Munitions Integration into HEMAP (HECOE)
- Spike Strip Evaluation (USAF)
- COTS CS Grenade Evaluation (USA)
- NL Range Requirements Evaluation (USAF)
- NLM Test Harmonization MOA Approval
- JIP MOA Update
- May 10 Meeting with the Mock Prison Riots
- Nellis AFB, NV Meeting (2-4 Nov)

## PERFORMERS:

- JNLWD (JIP Program Manager) – Frank Hubbard
- American Systems (JIP Researcher) – Jake Johnson
  - [jacob.johnson@americansystems.com](mailto:jacob.johnson@americansystems.com)
- Services to include USCG (JIP Voting Members)
- SOCOM / DHS / NGB / CBP / DoJ / BoP (Non-Voters)
- Various vendors with COTS (Material Vendors)
- DoS / DoE / ICE (Desired Non-Voting Members)

## PREVIOUS EVALUATIONS:

- Shotgun / NL 12 Gauge Ammo Performance Testing (2001)
- OC Dispenser Evaluation (2001)
- Personal Fire Extinguisher (PFE) Evaluation (2002)
- OC Dispenser / Taser Flammability Testing (2002)
- RCA Decontamination Evaluation (2002)
- Individual Flashlight Evaluation (2003)
- Dojo Target Evaluation (2004)
- Platoon sized Fire Extinguisher (2004)
- Combo Baton / Tigerlight Evaluation (2006)
- Portable Entanglement Device (Vessel Stopper) Evaluation (2007)
- Shotgun Launch Cup (Stingball Grenade) Evaluation (2008)
- 40mm Reloadable Training Round Evaluation (2008)
- Taser (M26 & X26) Aiming Laser Optical Evaluation (2008)
- NLMC I (2008) & II (2009)





# NATO / JIP Event



- NATO Defense Against Terrorism (DAT) – 11 / Joint Integration Program combining their NL Technology Demonstration with the Semi-Annual JIP Exhibition, Demonstration, and Industry Conference In Oct, 2011 at Connaught Range in Ottawa, Canada
- JIP Voting & Non-Voting Principals are invited
- Countries Involved: US, Canada, Belgium, Denmark, Netherlands, Norway, UK, Russia & Bulgaria
- All 20 Industry Reps that responded, responded positively
- Industry Challenges:
  - ITAR Compliance
  - Export Controls





# NL Breakout Session

4:30 Wednesday, 19 May



- Advancements in Personnel Incapacitation Methodologies for Multiple Projectile Cartridges
  - ✓ Mr Stephen Swann, Army Research Library
- Testing Non-Lethals – Finding the Right Tools for the Job
  - ✓ Mr Paulissen, TNO Netherlands Defence, Security & Safety



# What is your Response?



# ***USMC UPDATE***

***2010 JSSAST PANEL***

***18 May 2010***

***LtCol Mark Brinkman***  
***Program Manager***  
***Infantry Weapons***





## CURRENT EFFORTS

- Infantry Automatic Rifle
- Multi-Shot Grenade Launcher
- Rapid Engagement Precision Rifle
- Lightweight Company and Battalion Mortars
- Close Quarter Battle Pistol
- Foreign Weapons Kit



## FUTURE EFFORTS

- System Improvements based on human factors of fielded systems
- Long Range Sniper Rifle
- Lightweight Machine Guns





**QUESTIONS?**



# Office of Specialized Capabilities



**NDIA**  
**18 May 2010**

Captain Michael Price  
Commandant (CG-721)  
Office of Specialized Capabilities  
Coast Guard Headquarters





# Overview



- 12GA Flash Bang (LA51-LA52)
- Training Initiatives
- Handgun Replacement Project
- Near Term Projects
- Long Term Projects



# 12GA Flash Bang (LA51-LA52)



- The LA-51/ and LA-52 are 12 Gauge military shotgun rounds that when fired produce an airburst diversion at a range of 100 meters (LA-51) and 200 meters (LA-52).
- They have a classification of 1.4G (reference Crane Code 4083) and should be stored in normal pyrotechnics locker IAW OP5- ammunition ashore.





# 12GA Flash Bang (LA51-LA52)



- In May 2007 the Special Mission Training Center tested the LA-51 12 gauge 100 meter flash bang from a surface asset and determined the LA-51 was a more effective and safer warning shot than the M16 tracer.
- Flash Bang round is being used operationally for non-compliant vessel interdiction.
- Developing Operational, Test and Evaluation for point defense.





# Training Initiatives



- Simulators
- 12 Person Simulator Range
  - Air operated / Laser Scored
  - P229DAK (Other weapons can be added)
  - DT&E site for “Use of weapon simulators for basic pistol qualification” concept
  - Potential future savings from reduction in ammunition use and training costs.
  - Increased weapon handling experience
  - Potential for increased qualification rates





# Training Initiatives



- 100 Deployable classroom simulators in DT&E stage.
- Skills building.
- Judgmental Use of Force





# Near Term Projects

## Precision Service Shotgun

- Develop a Precision Service Shotgun (PSS) to be used for disabling fire.





## Long Term Projects



# Gyro Stabilized Weapon System

- Initiating a program for gyro stabilized weapon systems for small boats to enhance crew safety and effectiveness.





# Location & Organization



## ➤ Location.

Commandant (CG-721)  
Coast Guard Headquarters  
2100 2<sup>nd</sup> Street SW  
Washington, DC 20593

Phone: (202) 372-2030



## ➤ Organization.

- Office of Specialized Capabilities.
  - Member of the Joint Service Small Arms Synchronization Team (JSSAST).
- Organization Staffing.
  - Captain Michael Price (Chief, Specialized Capabilities)
  - Lieutenant Commander Sean Cashell (Chief, Use of Force Capability)
  - Chief Warrant Officer John McDaniel (Ordnance Branch, Small Arms).





Questions?

# ***Headquarters U.S. Air Force***

---

*Integrity - Service - Excellence*

## **USAF Combat Arms Program**

**Year of the Air Force  
Family**



**Mr. Randy Roth  
USAF Combat Arms  
Program Manager  
HQ Air Force Security  
Forces Center**



# ***USAF Combat Arms Program***

---

- **AF small arms strategy is to sustain current inventory and modernize as Joint member of sister service small arms programs**
  - **Harmonized requirements**
  - **Commonality in Joint arena**
- **Current programs with AF support**
  - **Individual carbine**
  - **Precision sniper rifle**
  - **Direct and indirect fire target acquisition and lethality for warfighters**



# USAF Combat Arms Program

## AF Modernization Efforts

**M203 GL**



**M320 GL**

**M2 MG**



**M2A1**

**M14 EBR**



**M4 A1**



Limited procurement for  
AF Guardian Angel CSAR



**SCAR L**

**SCAR H**

**EGLM**



# ***USAF Small Arms Interest Items***

---

- **Decreased weight of all combat weapon systems**
- **Improved accuracy, range and effects for precision weapons**
- **Environmentally safe small arms cleaner and lubricant**
- **Fused night vision technology**
- **On board power supply for optics/enablers**





# ***USAF Range and Training Interest Items***

---

- **Standardized range templates for use in new construction of base ranges; indoor and outdoor**
  - **Common bullet traps, target systems & ventilation**
  - **Mitigate potential health hazards (sound/air quality)**
- **Improved ventilation, sound reduction and range officer communication on existing ranges**
- **Full containment; eliminate encroachment issues**
- **More dynamic, realistic and interactive targetry**
- **Short-range & non-combustible tracer training rounds**



# Joint Service Small Arms Program



Malcolm Baldrige  
National  
Quality  
Award  
2007 Award  
Recipient

## Joint Service Small Arms Synchronization Team (JSSAST) Update



**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**

Presented  
By

COL Scott Flynn  
JSSAST Chairman



**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**<sup>1</sup>

- ▲ JSSAST Mission
- ▲ JSSAST Membership
- ▲ JSSAST Themes
- ▲ Awareness Campaign
- ▲ Current Programs
- ▲ What's Next?



**A Chartered Joint-Centric Activity**

**Providing Small Arms Technology  
&  
Requirements Harmonization**

**For All the Armed Services**

Focus on the  
Warfighter  
Always!

Charter Updated and Approved  
by ASA (ALT) Hon Claude Bolton  
31 Aug 04

\$14-17M  
Annual  
Budget



# Mission Statement

- Intensive Management of the DoD Small Arms Tech Base
- Harmonization of Requirement
- Transition to PM's for System Development and Demonstration
- Long Range Plans and Strategies
- Influence of International Small Arms Activities

***...for the Joint Service Small Arms Synchronization Team***





Meets  
Semiannually

## ***Chairman***

**COL Scott Flynn (Commander, ESIC)**

## **Principals:**

Army:	COL G. Ellerson(USA MCOE)
Marines:	LtCol M. Brinkman (MCSC)
Air Force:	Col P. Lopardi (HQ AFSFC)
Navy:	Mr. C. Zeller (OPNAV)
Coast Guard:	CAPT M. Price (HQ USCG)
SOCOM:	COL J. Smith (PEO SOF Warrior)

## **Associates:**

Army PMSW:	COL D. Tamilio (PEO Soldier)
JNLWD:	Mr. K. Swenson (JNLWD)



# JSSAST Themes FY08-10



## JSSAP Awareness Campaign:

- ➔ - Continue meeting with Service HQ's
- ✓ - Extend to the Office of the Secretary of Defense

## Lightweight Small Arms Technologies (LSAT)

- ➔ - Establishment of a Joint Requirement (ICD)
  - Build a jointly funded program for EMD

## Joint Small Arms Capabilities Assessment (JSACA)

- ➔ - Update current documentation
- ➔ - Evolve into DOD Roadmap for Small Arms.

## Joint Service Small Arms Master Plan (JSSAMP)

- ➔ - Update JSSAMP in FY10
- ➔ - Evolve into DOD Roadmap for Small Arms



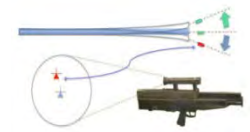
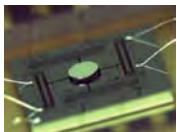
## Completed

- ✓ Director, Soldier Requirements, Army
- ✓ PEO SOF Warrior, US SOCOM
- ✓ PM Infantry Weapon Systems, USMC
- ✓ Director, Combat Arms and Training, USAF
- ✓ Director, Office of Special Missions, USCG
- ✓ PEO Littoral and Maritime Warfare, NAVSEASYS COM
- ✓ PM Soldier Weapons, Army
- ✓ Chief, Acquisition Division, JNLWD
- ✓ OSD Acquisition, Logistics and Technology
- ✓ HQDA Office of Director of Technology

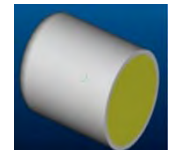
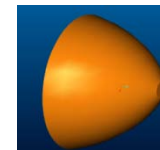
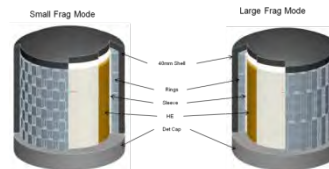
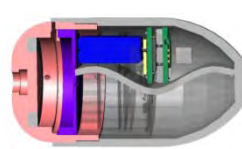
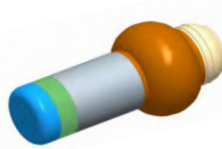
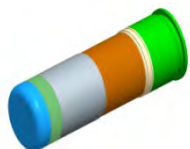
## Lightweight Small Arms Technology



## Advanced Fire Control Technology



## Advanced Lethal Armament Technology



- ▶ **Continue Operational Awareness Campaign**
- ▶ **Gain Approval of Joint ICD for Entire Small Arms Program**
- ▶ **Complete DOD Small Arms Roadmap**
- ▶ **Next JSSAST Meeting in November 2010**







# CENTER OF OUR STRENGTH

Project Manager Soldier Weapons

## Project Manager Soldier Weapons Briefing For NDIA

18 MAY 2010

BG Peter N. Fuller  
Program Executive Officer Soldier

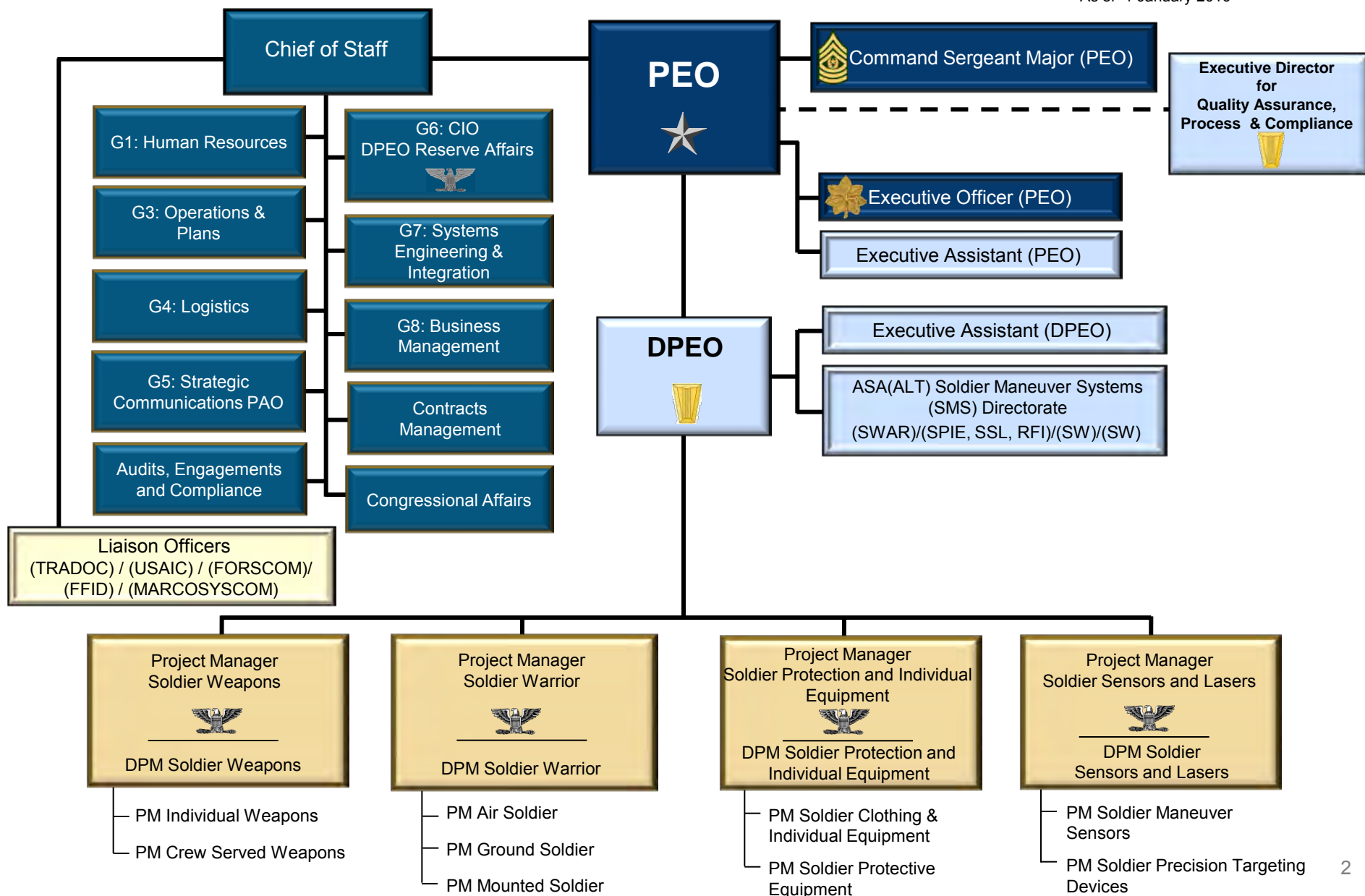
COL Douglas A. Tamilio  
Project Manager Soldier Weapons



# Program Executive Office Soldier



As of 1 January 2010



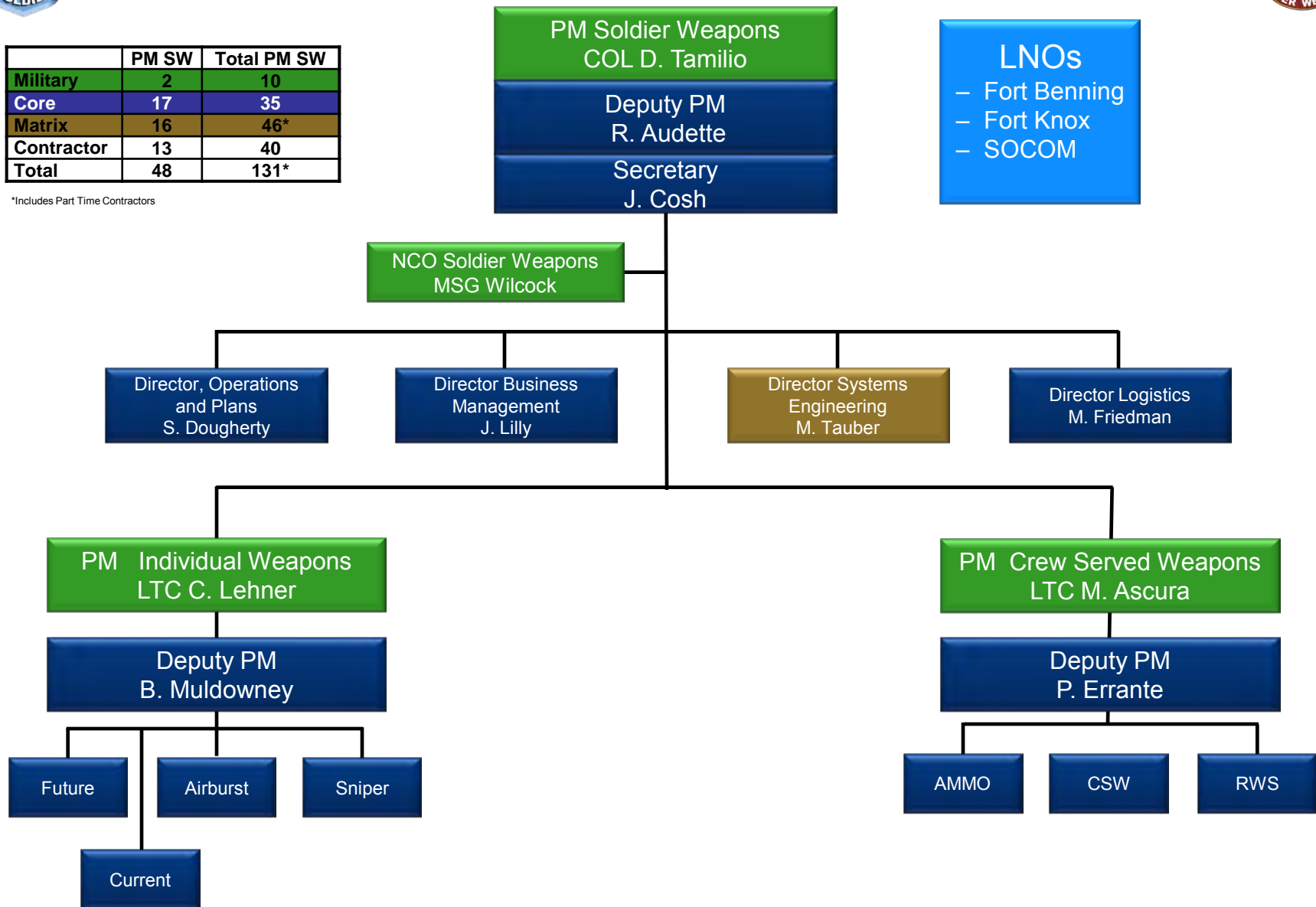


# Project Manager Soldier Weapons



	PM SW	Total PM SW
Military	2	10
Core	17	35
Matrix	16	46*
Contractor	13	40
Total	48	131*

\*Includes Part Time Contractors



## LNOs

- Fort Benning
- Fort Knox
- SOCOM





# PM Soldier Weapons Mission



## Current



M16A4 Rifle



M9  
Pistol



M4 Carbine



M320  
40mm Grenade  
Launcher



M4/M203



M110  
Semi-Automatic  
Sniper System  
(SASS)



M107  
Long Range  
Sniper Rifle



M240L  
Medium  
Machine Gun



M249  
Squad Automatic  
Weapon (SAW)



M240B  
Medium  
Machine Gun



M2  
Cal .50  
Machine Gun



MK19  
Grenade  
Machine Gun



M25  
Stabilized  
Binocular



M24  
Mini  
Binocular



M68  
Close Combat  
Optic (CCO)



M145  
Machine Gun  
Optic



Rifle Combat  
Optic (RCO)

## Development



XM25  
Counter Defilade  
Target Engagement System



M26  
Modular Accessory  
Shotgun System  
(MASS)



XM806  
Lightweight  
.50 Caliber  
Machine Gun



XM153  
Common Remotely  
Operated Weapon  
Station  
(CROWS)

## Future



Future  
Handgun

### Family of Weapons

#### Compact



Carbine



Light Machine  
Gun



Future  
Sniper Rifle

***“ Provide the best weapons to our Soldiers”***



# 2009 Successes
























- M320 Grenade Launcher
  - Fielded 10,000 to date (AAO 71,600 GLs)
  - Recently contracted Additional 12,000 GLs & \$3.8M spare parts
  - Soldiers praise its accuracy, ease of use, & modularity
- M4
  - AAO increase from 473,769 to 501,286
  - Acq Strat Apprv'd. for Heavy Barrel, Auto, Ambi - FY10 Production Contr (12k M4 converted to M4A1), FY11-12 Prod. Contr will be competed (full & open) for 24k M4A1.
- Individual Carbine CDD - In JROC Staffing!
- M26 - Approval to produce 1,800 LRIP shotguns, 3QFY11 initial Fielding
- M24E1- .300 WinMag, 1200m range, Down Select Ongoing, Initial Fielding 1QFY11
- M14 EBR-RI - 5,000 Weapons Produced & Fielded, New funding provided for 1,200 more
- XM25 - Fully Funded RDT&E, Finishing AROC staffing
- CROWS
  - UMRs Fielded systems on the Buffalo A1/A2/-1, RG31A1/A2/A3, RG-33, M1151, and M1A2
  - Integrating it on the MATV, JERRV, CAIMAN, and MAXPROPLUS
- M240L
- MK48 Urgent Materiel Release
- Lighten the Soldier Load





# Lighten Soldier's Load



Rifles/Carbines *	Shotguns	Machine Gun Tripods	Medium Machine Guns		Heavy Machine Guns	Heavy Machine Gun Tripods
<b>Before</b>  <b>M16A4, 8.13 lbs</b>	 <b>M500, 7.7 lbs</b>	 <b>M122A1, 18 lbs</b>	 <b>M240B, 27.3 lbs</b>		 <b>M2, 128 lbs</b>	 <b>M3, 44lbs (Including T&amp;E)</b>
<b>% Lighter</b>  <b>17% (-1.38 lbs)</b>	 <b>29% (-2.2 lbs)</b>	 <b>36% (-6.5 lbs)</b>	 <b>32% (-8.7 lbs)</b>	 <b>18% (-5 lbs)</b>	 <b>49% (-63 lbs)</b>	 <b>30% (-13 lbs)</b>
<b>After</b>  <b>M4, 6.75 lbs</b>	 <b>M26 MASS, 5.5 lbs</b> <hr/>  <b>M26 MASS Mounted on M4</b>	 <b>M192, 11.5 lbs</b>	 <b>MK48, 18.6 lbs</b>	 <b>M240L, 22.3 lbs</b>	 <b>XM806 Lightweight .50 Caliber MG, 65 lbs</b>	 <b>XM205, 31 lbs (Including T&amp;E)</b>
Systems Currently Fielded					Systems Currently in Testing	

\* Weapon Weight With Empty Magazine, No Sling, No Optic



# Ongoing Programs



# XM153 Common Remotely Operated Weapon Station (CROWS) System Description



**Fire Control Unit  
(FCU)**



**Control Grip  
(CG)**

- Four-Axis Targeting System
- Three-Axis Vector Stabilization
- Day Camera: 27X w/47 Degree FOV
- Thermal: Dual FOV (3° & 11°) w/ 2x E-Zoom
- Auto Focus (Day And Thermal)
- Laser Range Finder
- Auto Tracker / Auto Lead / Auto Scan
- Target Reference Points Scan
- Elevation: -20 to +60 degrees
- Traverse: 360 Degrees Continuous

- Weight (w/o Weapon And Ammunition)
  - Above The roof: 325 lbs (w/o Armor Kit)
  - Total weight: 430 lbs
- Supported Weapons:
  - M2 (400 rds) - M240 (1000 rds)
  - MK19 (96 rds) - M249 (1600 rds)
- Reliability: Minimum Of 1600 hrs MTBMA



## ***Potential Future Improvements:***

- Sniper Detection Capability
- Far Target Designation With Handoff
- Additional weapons (LW50, MK47, M134, Integrated Javelin Launcher)
- IR And Visible Pointers
- Enhanced Image Capability

# CROWS Fieldings



RG31A1

Buffalo



M1151



JERRV



M1A2



RG33

MRAP Vehicles in progress





# XM806 Lightweight .50 Caliber Machine Gun



- **Lightweight**
  - Two Man Portable (62.0 Vice 128 lbs M2HB)
  - Can Be Dismounted From Vehicle Platform And Remounted On Ground Mount <30 Seconds
- **System Dispersion-1.1 Mils (Ground Mount No Ballast)**
- **No Headspace Or Timing Adjustment**
- **Minimized Logistic Impact: 133 Parts LW50 vs. 244 Parts M2HB**

**Low Recoil = More Hits/Less Dispersion**

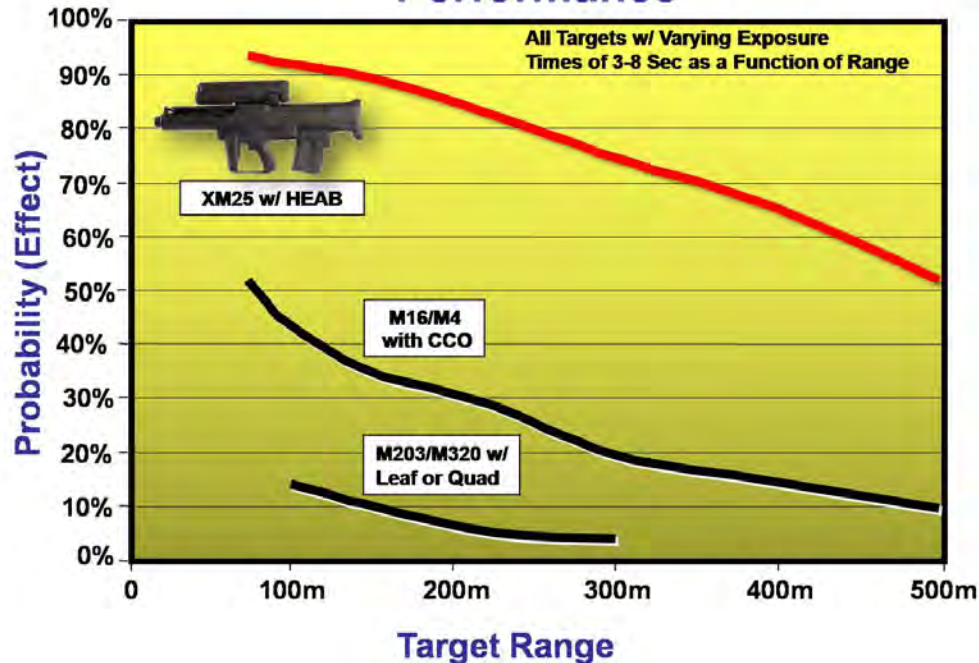




# Counter Defilade Target Engagement Weapon System



## Performance



### System Description:

- 3 Components that are Highly Integrated & Optimized to produce noted P(effect):
  - Semi-auto, Magazine Fed, 25mm Weapon
  - Programmable, Low Velocity, High Explosive Air Burst (HEAB) Ammo
  - Fully Integrated Day & Thermal Night Sight w/ Full Solution Target Acquisition/Fire Control
- System Weight: 12.0-12.5 lbs

### System Capabilities:

- Defeats Defilade Targets And Exposed Targets
- Point Target Range: 500 meters
- Area Target Range: 700 meters

### Status:

- Contractor Integration Testing: Aug 08
- Government Testing at APG: Sep 08 – Present
- Limited Safety Release: 4QFY09
- MS B: 3QFY10
- MS C: ~3QFY12

### Current Development

### Future Development



25mm Ammo





# M2E2 Quick Change Barrel Kit



## ***System Description:***

- Quick Change Barrel
- Barrel Support
- Barrel Extension
- Solid Breech Lock
- Flash Suppressor\*

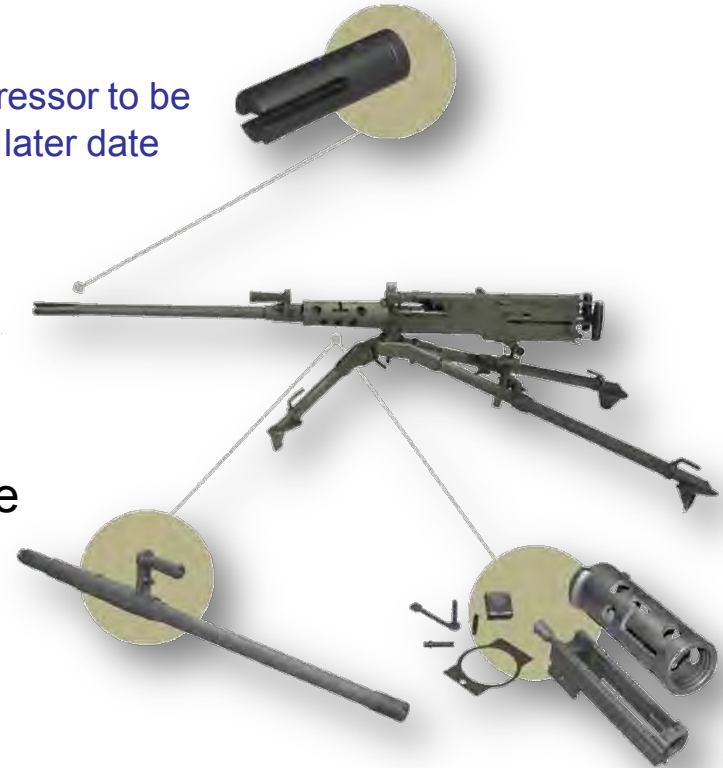
## ***Capabilities:***

- Enhancement will increase readiness by providing a faster & simpler barrel change without the need to set headspace and timing
- Reduces Training
- Includes Flash Suppressor

## ***Status:***

- Production Verification Test at Aberdeen Test Center – May thru Oct 09
- Limited User Evaluation at Ft. Benning – Jul 09

\* Flash suppressor to be fielded at a later date

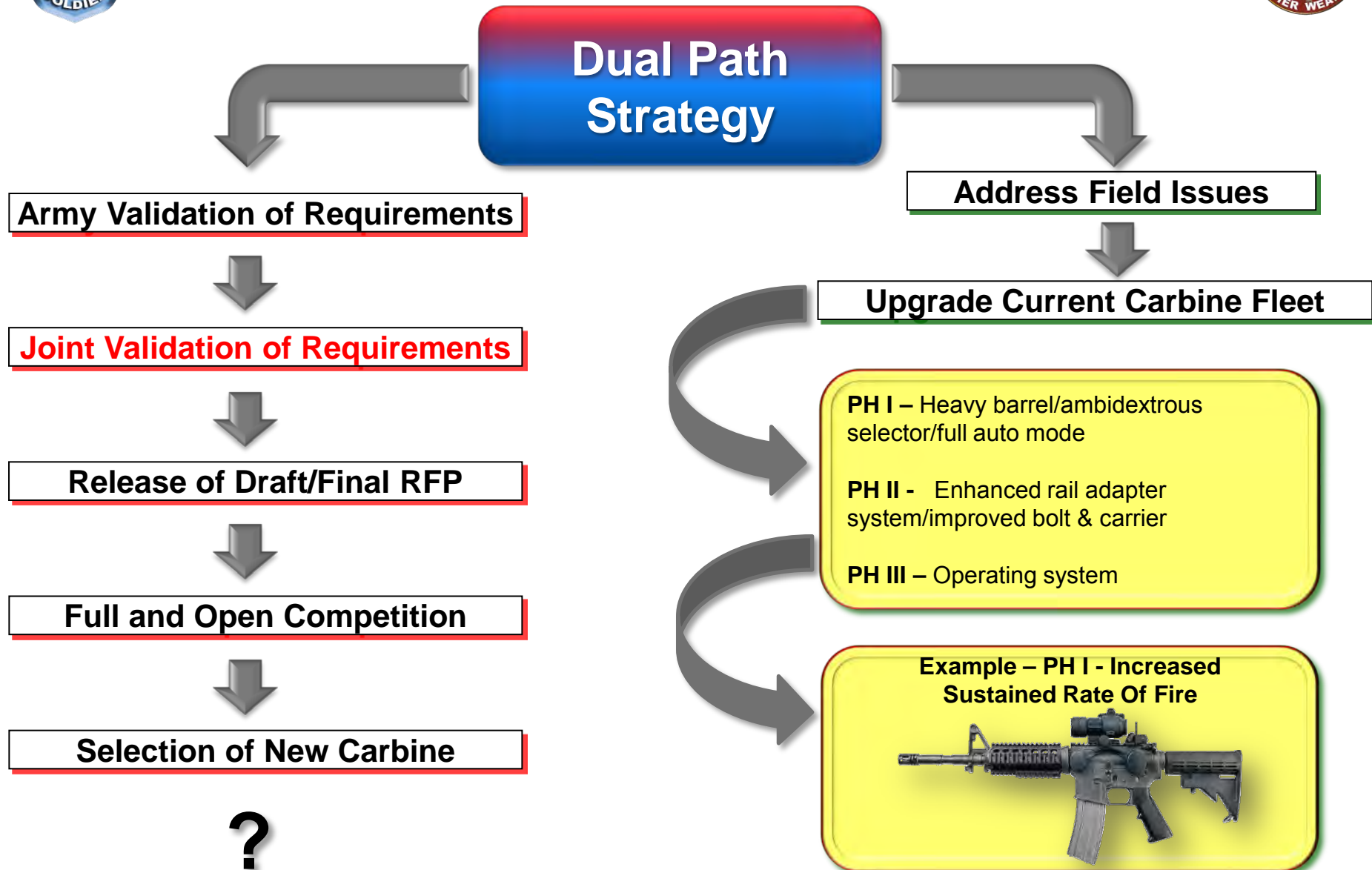




# Future Business Opportunities



# Carbine Path Forward





# Individual Carbine Competition



## ***Description:***

- The Individual Carbine (IC) will provide the US Soldier with the most accurate, reliable, durable, maintainable, and modular individual weapon with improved features such as ambidextrous controls and at a best value to the US Government

## ***Capabilities:***

- Carbine will provide accurate and reliable firepower
- Semi-auto and full auto fire
- Integrated rails will accept Mil-Std-1913 rail mounted accessories
- Fully ambidextrous

## ***Status:***

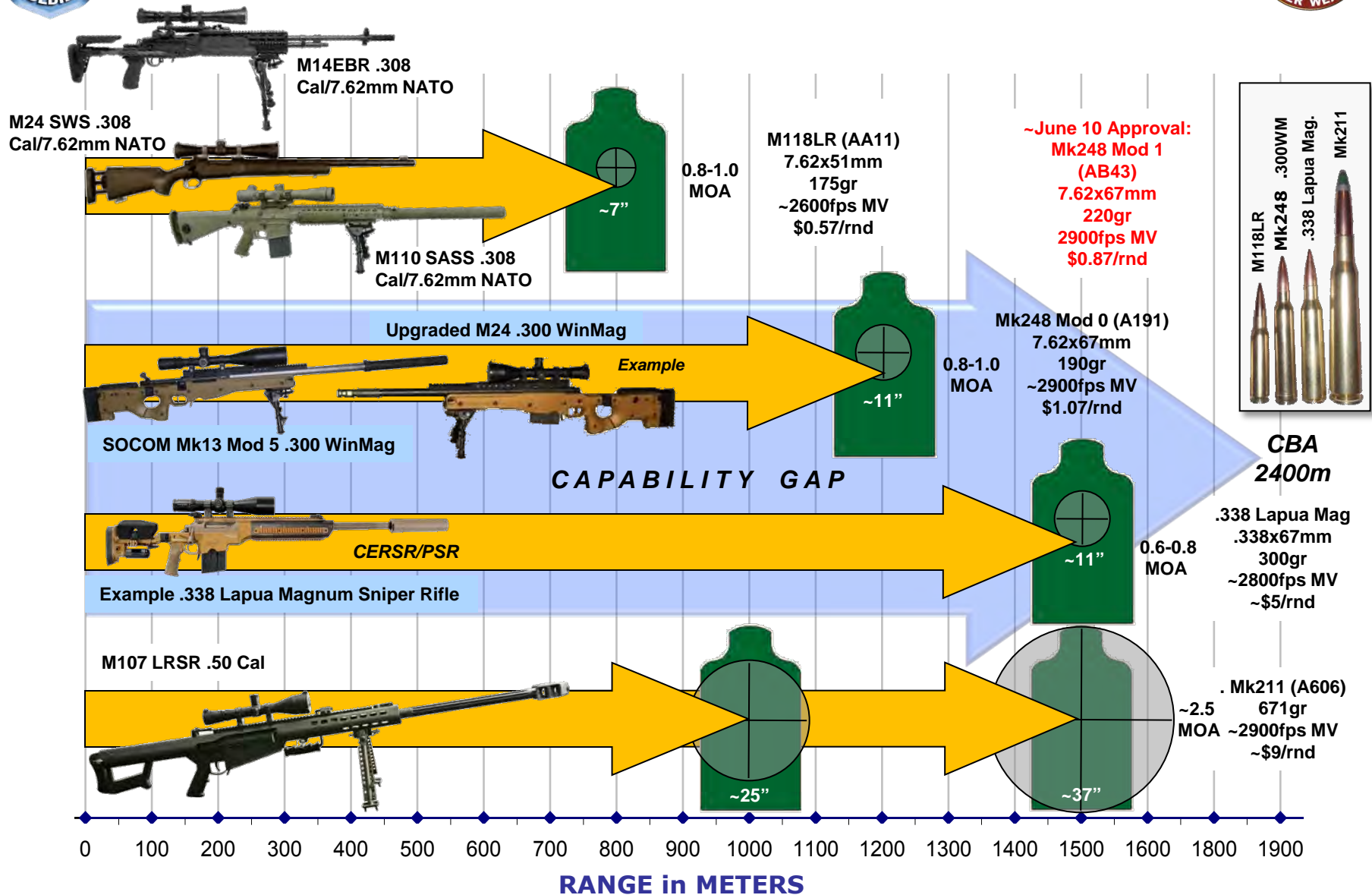
- CDD in Joint Staffing – 10 May 2010
- Congress provided RDT&E for FY10
- Release draft RFP 1QFY11
- Industry Day 1QFY11
- Final RFP 2QFY11





# Precision Weapon Portfolio

## Engagement Ranges & Dispersion





# Sniper Weapons Suite



- M107 Long Range Sniper Rifle – Cal .50 Anti-Materiel System (1000-2000m)
  - Production complete
  - Fielding complete
  - Defining Product Improvements



- M110 Semi-Automatic Sniper System - 7.62mm (800m)
  - 2307 delivered (2943 AAO)
  - USMC adopted for REPR program



- M24 Sniper Weapon System – 7.62mm (800m)
  - M24E1, .300 WinMag (1200m) to be produced
  - Downselect for M24E1 Ongoing, Fielding 1QFY11



- Precision Sniper Rifle – Cal ?, 1500m
  - CDD released for World Wide Staffing 18 May 10



# M14 Enhanced Battle Rifle



## *Description:*

- M14 Enhanced Battle Rifle is a rack stock M14 rifle mated to an enhanced aluminum billet stock, Tactical Scope and Cantilever Mount. This weapon was built by Rock Island Arsenal in response to numerous Operational Need Statements requesting long range capability.

## *Capabilities:*

- Accurate 7.62mm capability out to 800m

## *Status:*

- 5000 Wpns produced & Fielded; Funding provided to produce additional 1200 Wpns
- Potential for Night Vision





# FY 10 Technology Shortfalls



Lethality	Mobility
✓ <b>Accurate Range Determination</b>	✓ Lightweight, High Strength Materials for Small and Medium Caliber Weapons
✓ Nano Explosives/Nano Propellants	✓ Multi-Function Laser
✓ Miniature Non-Magnetic Direction Finding System	✓ Reduced Weight and Power Consumption Electronic Components
✓ <b>Lightweight, Direct View Optics</b>	✓ Wireless Weapon Interface
✓ Course Correcting Small Arms Projectiles	<b>Survivability</b>
✓ Inexpensive, High Brightness, High Resolution, Low Power, Color, Wide Temperature Range, Long Life, Ruggedized, Lightweight, Micro Video Display	✓ Luminescent Materials
✓ Improved Incapacitation for 5.56mm, 7.62mm, 9mm Ammunition	✓ <b>Reduced Weapons Signature</b>
✓ <b>Adjusted Ballistic Reticle for 5.56mm and 7.62mm Rifles</b>	<b>Sustainment</b>
✓ Covert Marking Ammunition for Small and Medium Caliber Weapons	✓ <b>Wear Resistant Coatings for Weapon Mechanisms</b>
<b>C4I / Battle Command</b>	✓ Higher Energy Density Mini-Battery
✓ Reconnaissance Munition	✓ Central Power Source



# Summary



- Thank you for your responsiveness
- Understand the change in fiscal environment
- Incremental vs. Revolutionary





# Questions



# CENTER OF OUR STRENGTH

Project Manager Soldier Weapons

## PM SOLDIER WEAPONS ASSESSMENT TEAM

18 May 2010

MAJ Shawn Murray  
MAJ Elliott Caggins



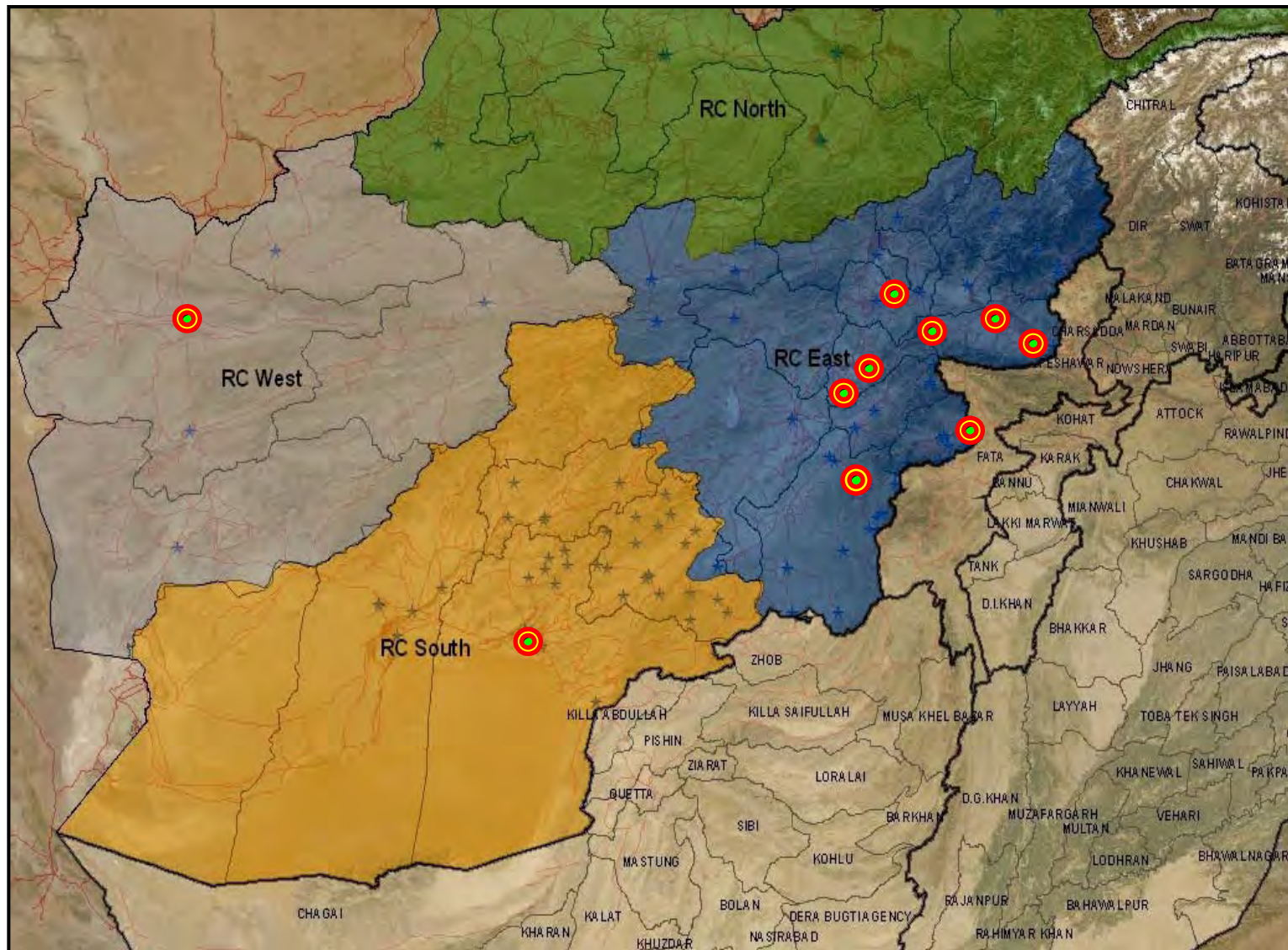
# Agenda



- Afghanistan and the Interview Area
- Findings
- Individual Weapons
- Crew Served Weapons
- Acquisition Issues
- Questions



# INTERVIEW POPULATION







# The Context



- Each ridgeline brings a different set of wants versus needs...everything is relevant!
- Leader and Soldier feedback varies, but most comments support some general themes.
  - **OIF v. OEF are markedly different...extended ranges refer to OEF for the most part.**
- The PM SW Assessment Team walked into this assessment with an open mind, willing to travel throughout the CJOA and focused on giving our deployed units a voice.
- The Assessment Team was to deploy to OEF for no more than 17 days.
- Team Members: MAJ Elliott Caggins, MAJ Shawn Murray, MAJ Tom Aarsen and MSG Paul Wilcock





# THE BLUF



1. Menu of approved Carbine accessories.
2. Simple camouflage applications for Carbines and Optics.
3. Suppression (noise/flash) technology.
4. Need for variable powered Optics for Carbines.
5. Increased firepower (caliber) at extended ranges.
6. Organic Designated Marksman Rifle at the Platoon/Squad level.
7. Increased modularity.
8. ASAK per Sniper weapon.





# M4/M16 SERIES RIFLE



## M4/M16:

- ☐ **Menu of approved Carbine accessories.**
  - ☐ COTS Butt Stocks, Magazines, Slings, Bi pods, Handgrips
  - ☐ COTS Scopes / Optics
  - ☐ COTS Suppressors
  - ☐ In extreme cases, Soldiers have purchased upper receivers and high-costs rifle scopes.
- ☐ **Simple camouflage applications for Carbines and Optics.**
- ☐ **Suppression (noise/flash) technology for Carbines.**
- ☐ **Need for variable powered Optics for Carbines.**
- ☐ **Increased firepower (caliber) at extended ranges.**



# M14 ENHANCED BATTLE RIFLE



- ☐ NET remains critical to shooter/maintainer proficiency / Many types of units use this weapon.
- ☐ STRAC allocation affects availability of M118LR.
- ☐ Soldiers are removing/replacing Mk4 Leupold scope with other scopes.
  - ☐ MILDOT reticle training delta
  - ☐ Simple point and shoot reticle pattern
- ☐ Stock is adequate, but there is room for improvement.
  - ☐ Reduce bulkiness
  - ☐ Remove unnecessary parts
- ☐ General theme = DMR is **REQUIRED** organically in Infantry formations.





# Mk 48 LIGHTWEIGHT MACHINE GUN



## Mk 48 LMG:

- ☐ Original intent was to replace the M240B until the M240L was to be fielded.
- ☐ Possessing increased firepower and controlling extended ranges has forced:
  - ☐ Replacement of the M249 SAW by the Mk48 LMG
  - ☐ Lethality trumps Weight Reduction when extended fires are required
- ☐ Leaders want to adopt the Mk48 LMG



M240B/L

Mk48 LMG



M240B



M240L







# Miscellaneous



Typical Observation Post (OP) field of fire along IED avenue of approach



M16A2 with M68 CCO and bipod mounted...no M1913 Rails.



M320GL mated to M4 Carbine...weapon painted, no sights for M320GL





# Acquisition Issues with Small Arms



- Vendors sent items in theater/home station
  - Lubricant:
    - Company was sending free samples to soldiers in theater with the claim that the lubricant was superior to the Army approved lubricant (CLP)
    - Testing done over several months (-46°C to +71°C) proved that the superior lubricant was CLP
- Unit purchased items that modify weapons
  - Suppressors
    - BCT bought suppressors for Team Leader and above.
    - Provides difficulty in determining:
      - Suitability
      - Long Term Reliability



# Acquisition Issues with Small Arms



- M4 Bolts
  - There is no need for lubricating the weapon
  - Less cleaning is required for maintenance
  - There is considerably less fouling and debris build up inside the weapon
  - The coating on the bolt will never rub off or flake off
  - The weapon operates cooler than one with a regular bolt.
- Testing was done by 5 soldiers who fired 1,000 each of M200 Blank and M855 ball under range conditions
- Soldier purchased items that modify M4 Carbine
  - Magazines
  - Buttstocks

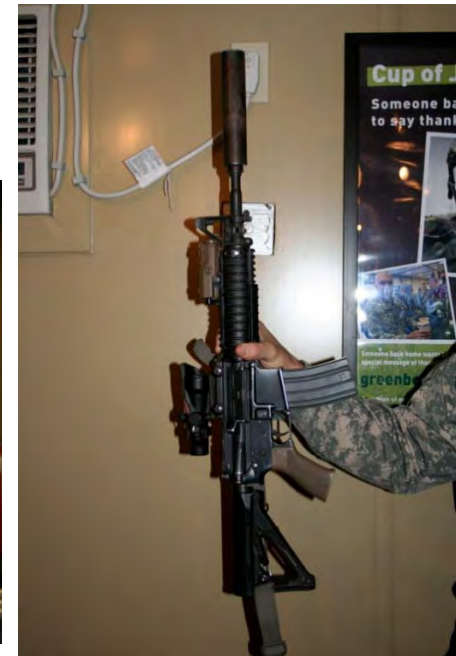


# Personally Equipped and Unit Purchase



By choosing to purchase equipment that has not been provided from the Army, individuals and unit commanders:

- Violate established Army Policy
  - AR 750-10 Army Modification Program
- Increase risk to Soldiers

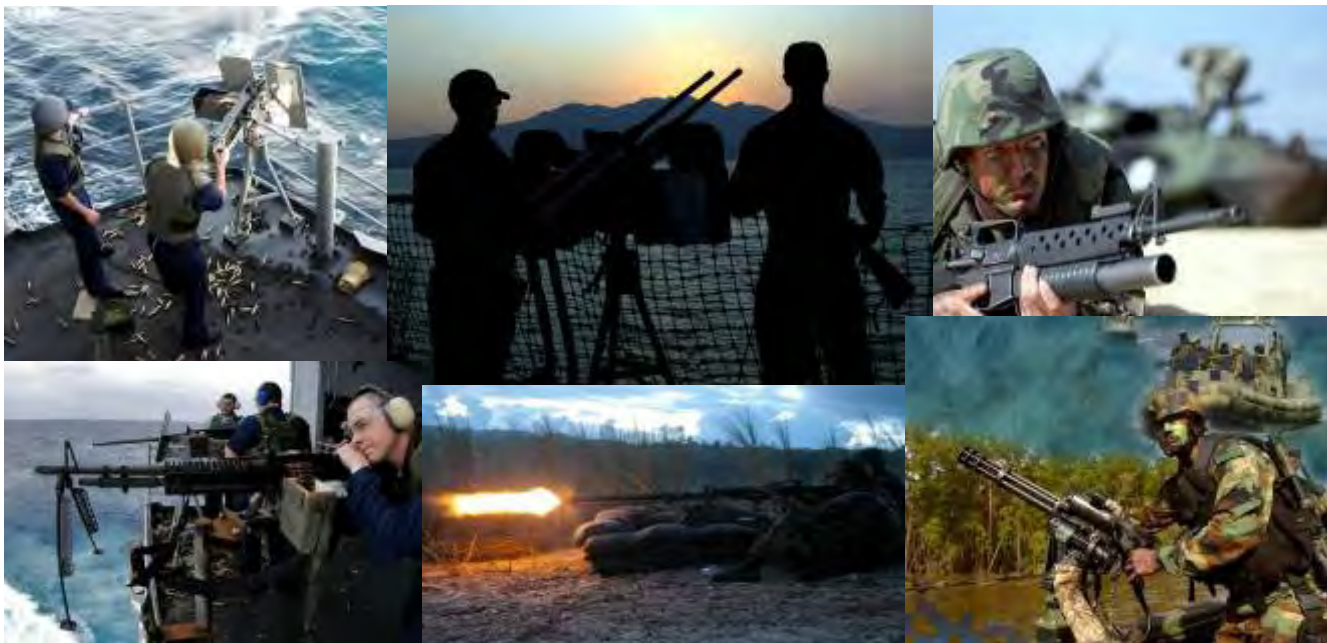




# QUESTIONS?



# NAVY SMALL ARMS



**CDR Thomas Gajewski**  
**Program Manager, PMS-340**  
**Email: [Thomas.Gajewski@navy.mil](mailto:Thomas.Gajewski@navy.mil)**  
**Phone: (202) 781-5782**





# Navy Small Arms Program Overview

- Full life cycle support for the Navy's small arms
  - Engineering
  - Acquisition
  - Maintenance
  - Weapons distribution
  - Weapons Tracking
- Acquisition and acquisition support are provided for all small arms, mounts and related equipment
  - **Majority of acquisitions are from Army or direct from OEM**
  - **Occasional modifications to in-service weapons/mounts**
  - **1,223 worldwide activities**
  - **Over 422,000 weapons**







# Navy Small Arms Program

## Road Map



## Small Arms Modernization Way Ahead













FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015
Pistols									
				M9					
				M11					
				Sig Arms P229					
				Sig Arms P239					



## Small Arms Modernization Way Ahead (Cont.)

### Obsolete Systems

### Modernization Program










FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015
Medium Machine Guns									
	M60				M240N/B				
	M60E3 / MK43				MK48 LWMG				
Mounts									
	MK26 MOD17				Universal Mount MK93				
	MK64 MOD 4								
	MK82				MK97 Mount				
	MK58								
Carbines									
	Colt 727 Carbine				M4A1 Carbine				



## Small Arms Modernization Way Ahead (Cont.)

### Obsolete Systems

### Modernization Program

FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015
Rifles									
 <b>M16A1HB</b>			 <b>M16A3/5</b>						
 <b>M14</b>									
40MM Grenade Launcher									
 <b>M79</b>					<b>M203</b>				
Surface Ship Machine Gun									
 <b>MK19 GMG</b>					<b>Twin M2HB MG</b>				
 <b>MK44 Mini Gun</b>					<b>Twin M240 MG</b>				





# Navy Small Arms Program

## On-going efforts



## SPS - Lethal Effector (LE) MK49 Mod 0

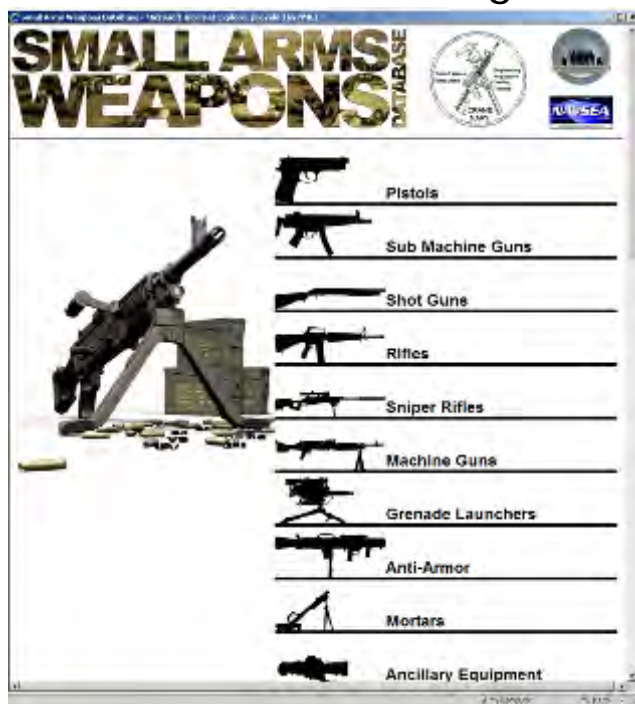


- Remotely Operated Small Arms Mount (ROSAM)
  - Provides automated, integrated, sensor equipped, and remotely controlled platform that can accommodate a variety of weapons.



# Increase Communications

- New website
  - Provides weapons information to the fleet; manuals, engineering bulletins, photos
  - Frequently asked questions
  - Linked with Data management registry and allowance data base







# Fighting Corrosion - Weapons







# Fighting Corrosion - Ammunition







## What can industry do for Navy Small Arms?

### •Ship Board

- Problem - Harsh sea environment corrodes weapons
- Need – Improved maritime coatings or materials
- Problem – Weapons and ammunition are stowed below deck and must be transported top side using ladders, hatches, etc.
- Need – Lighter, smaller, more compact weapon and ammunition
- Problem - Weapon round counts are inaccurate
- Need – Automatic round counters

### •Navy Shore Stations

- Problem – Increased training requirements for crew served weapons
- Need – Reduced range training ammunition for M240, M2HB, MK19, virtual simulators, etc.
- Problem – Increased security at check points at base entrances and piers.
- Need – Ability to choose between non-lethal or lethal force, rapid transition from less than lethal to lethal

### •Naval Air

- Problem – Overheating barrels on XM218 / GAU16 barrels
- Need – Barrels that can be fired maximizing the number of rounds on target per aircraft pass



*Fort Benning, Home of the MCOE*

# Small Arms NDIA Army User Update

May, 18 2010

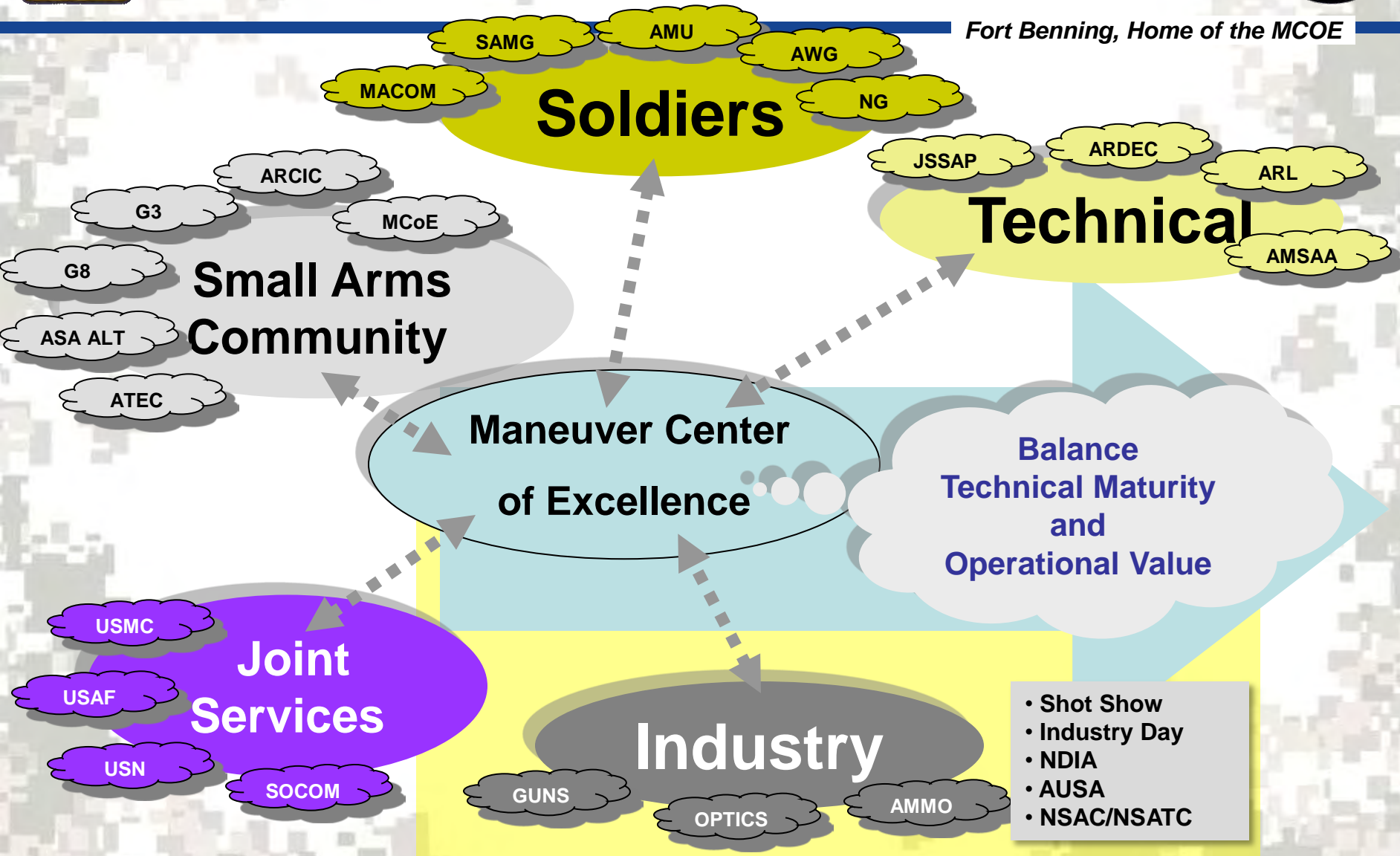


**LTC Tom Henthorn**  
**Chief, Small Arms Branch**  
**Soldier Requirements Division**  
**Maneuver Center of Excellence**



# Strategic Communications

Fort Benning, Home of the MCOE



Fort Benning, Home of the Soldiers, Leaders, and Families from the Best Army in the World!

19-May-10





# Small Arms Vision



*Fort Benning, Home of the MCOE*

- Understanding that we are a nation at war, we look to maintain and improve on an over-matching capability against our enemies in all operational environments
  - We will provide US Soldiers with operationally relevant, state-of-the-art systems that consider how to best employ resources to meet Soldiers needs
- 
- Field **evolutionary** capabilities to support near term mission
    - Performance
    - Reliability and durability
    - Weight (Soldier load)
    - Safety
  - Develop **revolutionary**, operationally significant capabilities
  - Increase the **understanding** of small arms capability



# Current



*Fort Benning, Home of the MCOE*

- Fielding
  - M110 Semi-automatic Sniper System (SASS)
  - M320 Grenade Launcher
- Coming Soon
  - M2A1, quick change barrel, fixed headspace and timing
  - M240L, lightweight medium machinegun
  - M24 Upgrades, 300 WinMag
  - M855A1, lead-free slug
- Requirements
  - Individual Carbine (IC)
  - Counter Defilade Target Engagement (CDTE)
  - Precision Sniper Rifle (PSR)





# Requirements Development



*Fort Benning, Home of the MCOE*

- Dual Combat Optic (true x1 to x 6-8)
- Medium and Heavy Machinegun Optics
- Grenadier Laser Range Finder (GLRF)
- Ammunition Requirements
- Small Arms Suppressors
- Sub Compact



# Increase Understanding of Capabilities



*Fort Benning, Home of the MCOE*

- Modeling and Simulation
- Soldier System performance (*SWEAT*)
- Riflemen configuration
- Mounted machinegun performance
- Baseline ammunition profiles
- Suppressor metrics
- Combat knife metrics



*Fort Benning, Home of the MCOE*

# Questions?



## ***NDIA Joint Armaments Conference***

## ***Brigadier General Michael M. Brogan***



**18 May 2010**





## Current Activities

- M16A4/M4/M4A1
- Additional weapons about to field to compliment capability
  - M27 Infantry Automatic Rifle
  - M32 Multi-Shot Grenade Launcher
  - Rapid Engagement Precision Rifle







## Marine Rifle Squad

### Mission

- To locate, close with, and destroy the enemy, by fire and maneuver, or repel the enemy assault by fire and close combat

The Next Service Weapon



## Next Service Weapon

- Procured as a system
  - Weapon
  - Ammunition
  - Target Acquisition
  - Training Systems
- Warfighter





## Weapon?

- One Weapon
- Family of Weapons
  - Personal Defense Weapon
  - Carbine
  - Combat Assault Rifle
  - Service Rifle
  - Designated Marksmanship Rifle
  - Infantry Automatic Rifle





## Ammunition?

- General Purpose

- Caliber

- 4.6 mm
- 5.56 mm
- 6.5 mm
- 6.8 mm
- 7.62 mm
- Other?



Trade Study to Compare  
Performance  
Training Impact  
Weight  
Stowed Kills?



## Target Acquisition?

- Day Optic
  - Magnified
  - Reflex
  - Both
- Night Sight
  - I<sup>2</sup>
  - Thermal
  - Fused
- Both
- Pointer/Range Finder
- All of the above



## Training Systems

- Ranges
  - Marksmanship
  - Moving target
  - Combat
- Simulators
- Devices
  - Sub-caliber
  - Paintball
  - MILES



## Other Considerations

- RAM-D
- Tech Data package





# Questions?



**National Defense Industrial Association**

## **Joint Armaments Conference**

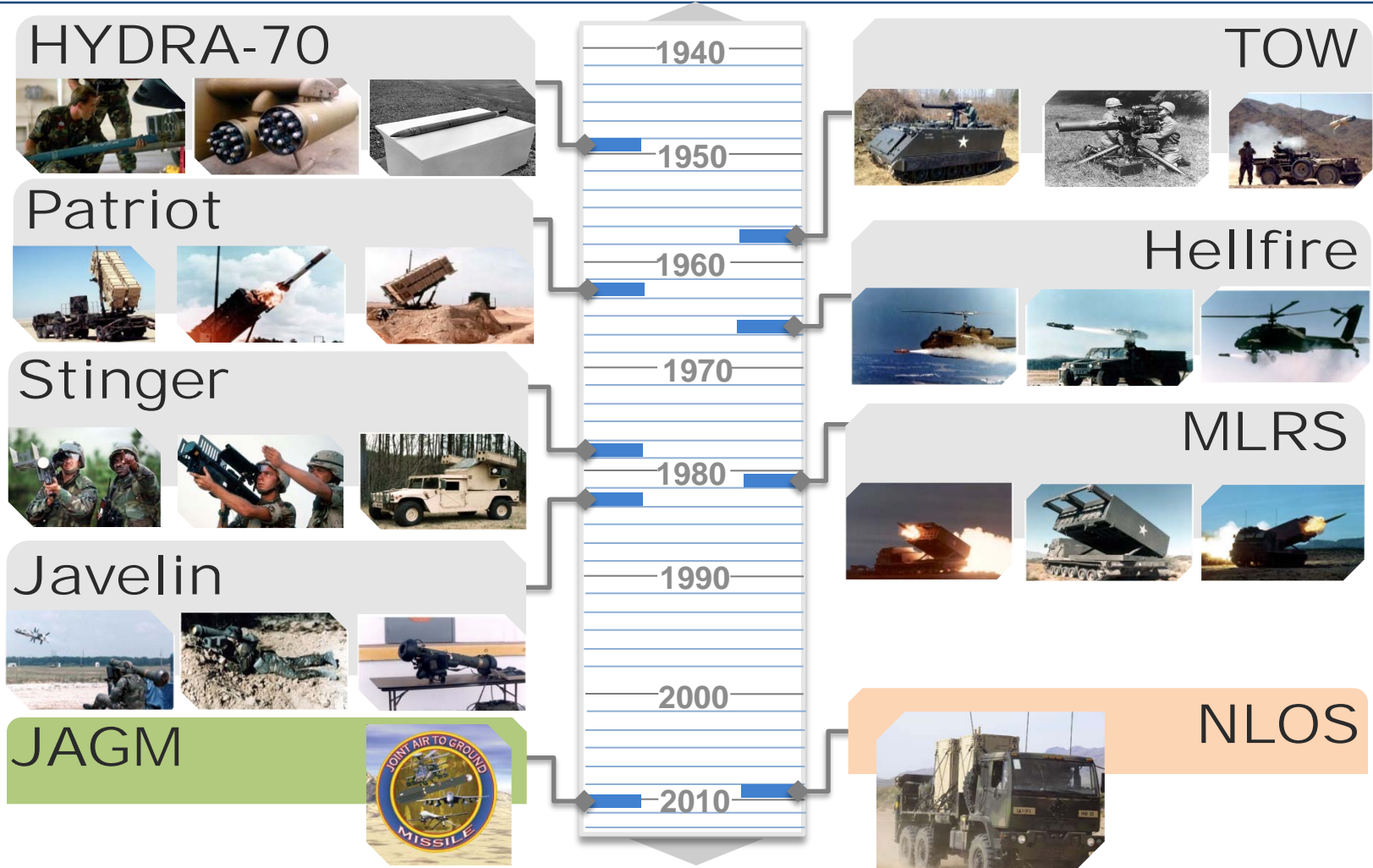
**Affordable, Reliable, Precise:**  
Finding the Right Mix

**Mr. Mike Mulligan**

May, 2010

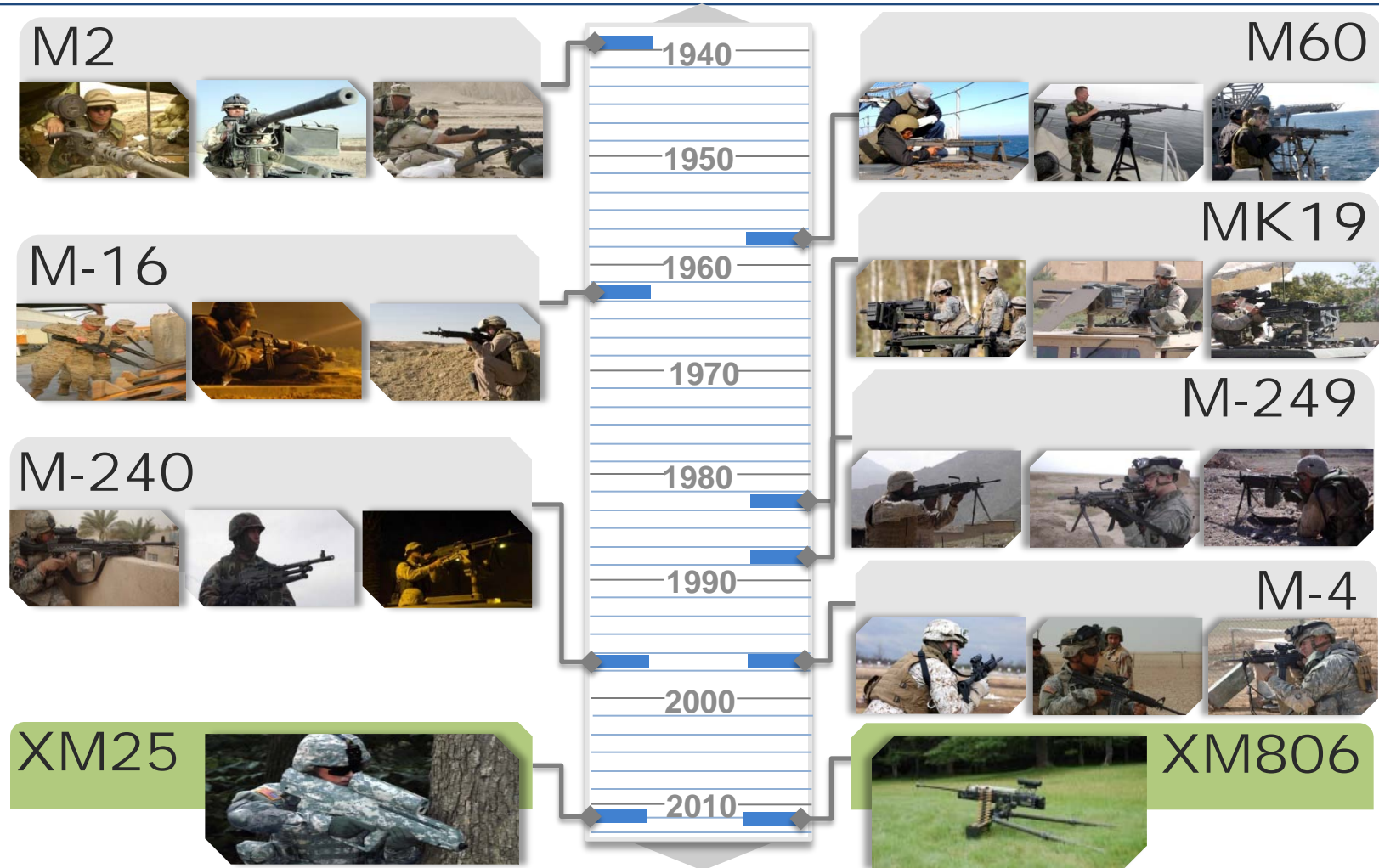


# Many US Rockets And Missiles Programs Were Developed 20+ Years Ago





# We Are Fighting Today With Guns Whose Designs Are Decades Old



# Protection Systems Must Balance Three Attributes

**PROTECTION**



**Right  
Responses  
=  
Balanced  
Attributes**



**COST**

**WEIGHT**

# For Armaments the Attributes Change

**RELIABILITY**



**Right  
Responses  
=  
Balanced  
Attributes**



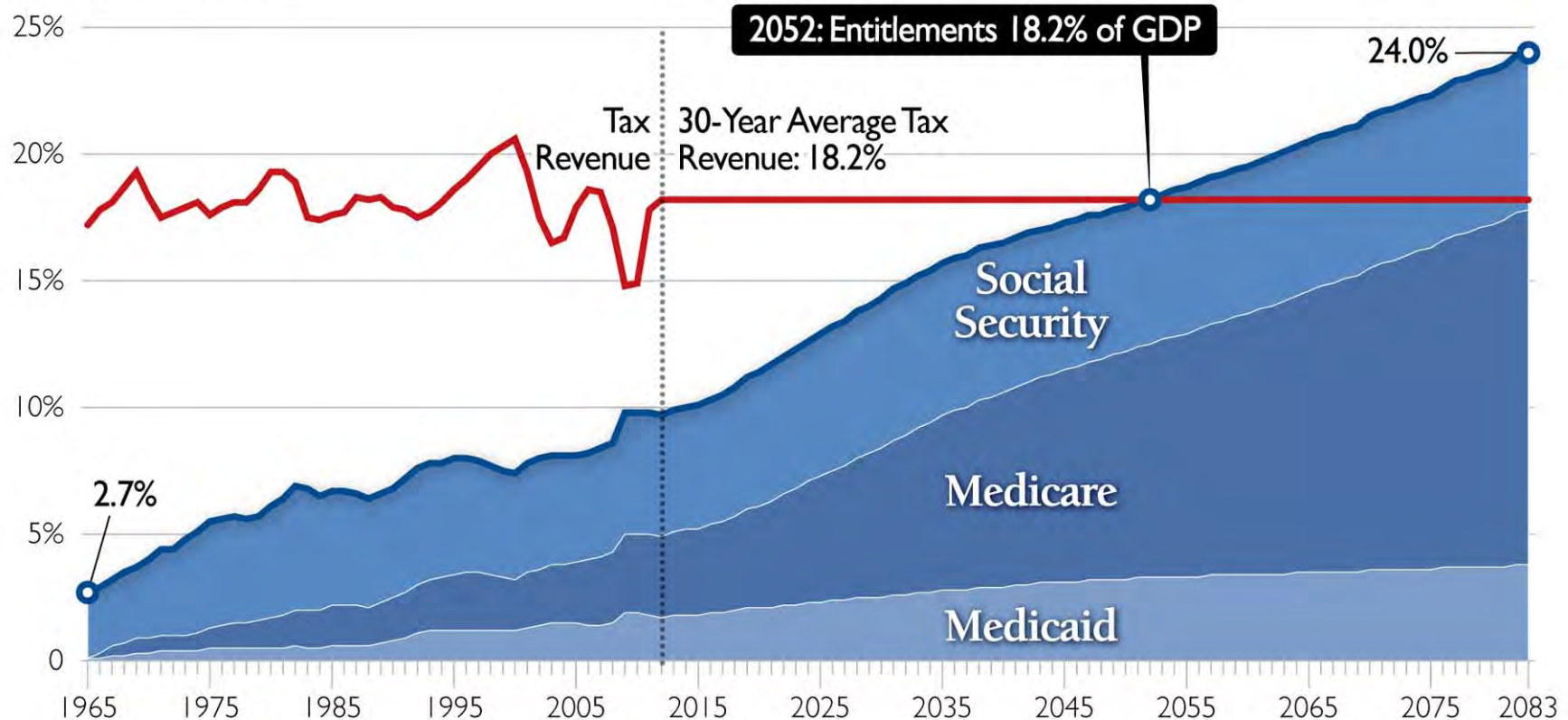
**COST**



**LETHALITY**

# Entitlement Growth Will Consume Discretionary Spending By 2050

PERCENTAGE OF GDP



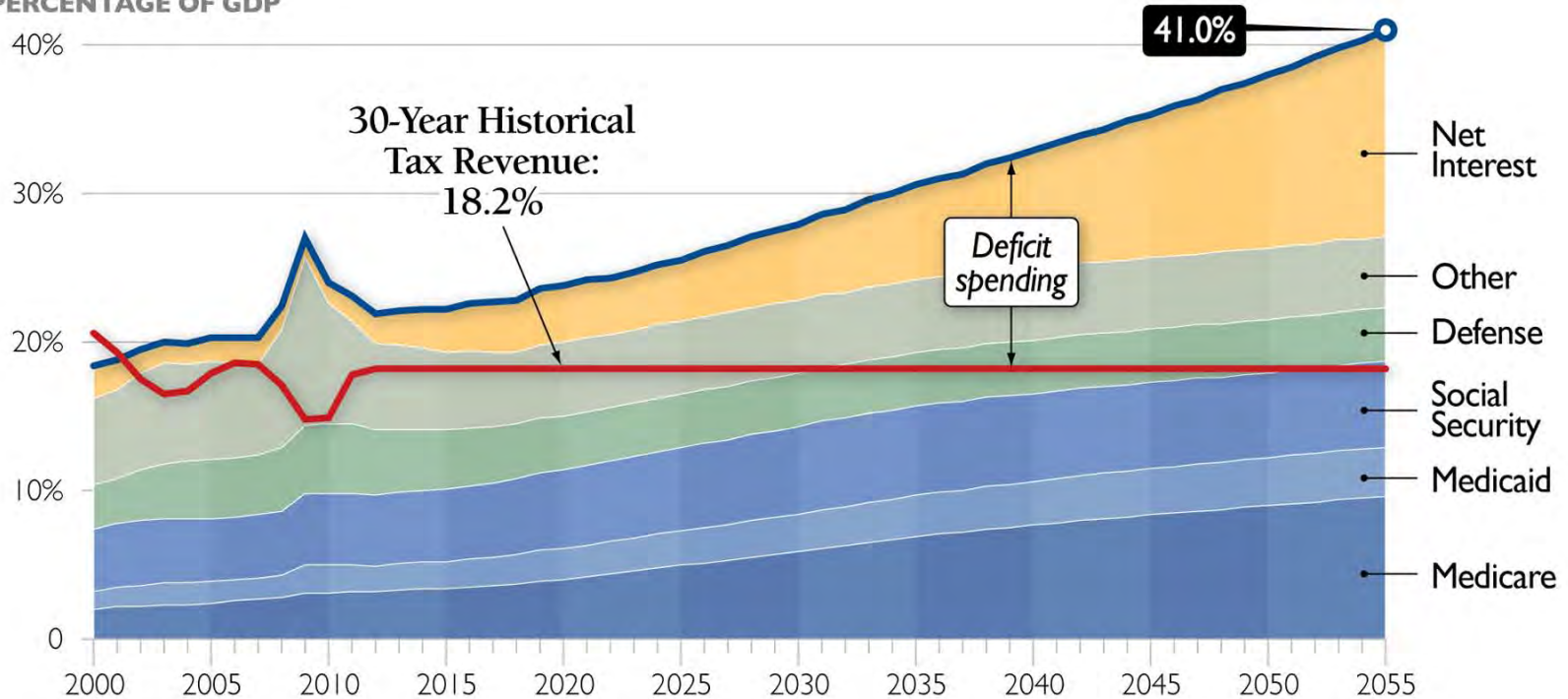
Source: Congressional Budget Office.

Entitlements Chart I • 2010 Budget Chart Book [heritage.org](http://heritage.org)



# When Add Servicing Costs for Debt, Picture Gets Worse

PERCENTAGE OF GDP



Key Projections – 2055 (as a percent of GDP)

## Spending Deficits

● Total Spending	41.0%
● Revenue	18.2%
<b>Deficit</b>	<b>-22.8%</b>

## Other Spending

● Net Interest	13.9%
● All Other	4.8%
● Defense	3.6%
<b>Total</b>	<b>22.3%</b>

## Entitlements

■ Social Security	5.8%
■ Medicaid	3.3%
■ Medicare	9.6%
<b>Total</b>	<b>18.7%</b>

Source: Heritage Foundation calculations based on Congressional Budget Office data.

Entitlements Chart 6 • 2010 Budget Chart Book [heritage.org](http://heritage.org)



# The Right Response Balances Lethality with Cost and Reliability

---

- ✓ Lethality must be scalable with reduced collateral damage
- ✓ Cost must be what the nation can afford balancing competing requirements.
- ✓ Reliability must be at least as good as current systems



# Joint Armaments Conference



# *PEO Soldier Mission*



Survivability



Lethality

Operating Environment

# Soldier Lethality

➤ M16 AAO = 610,572

➤ M4 AAO = 500,598

➤ Rifle Combat Optics

➤ Thermal Weapon Sight

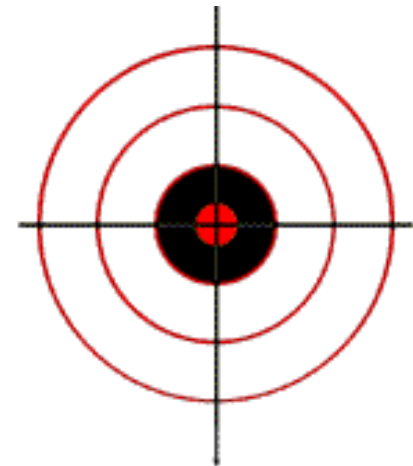
➤ Laser pointer/ranger finder

## 2006 CNA Study

- “more lethality”
- “better reliability”



## *Effectiveness*



➤ Virtual Marksmanship Trainer

➤ Increased STRAC funding

➤ M855

➤ M855A1 LFS

➤ SOCOM SOST

## Post Combat Surveys

- 93% satisfied

**Need To Continually Evolve Holistic Solutions**



# Carbine Path Forward



## Dual Path Strategy

Address Field Issues

Upgrade Current Carbine Fleet

PH I – Heavy barrel/ambidextrous selector/full auto mode

PH II - Enhanced rail adapter system/improved bolt & carrier

PH III – Operating system

Example – PH I - Increased Sustained Rate Of Fire



Army Validation of Requirements

Joint Validation of Requirements

Release of Draft/Final RFP

Full and Open Competition

Selection of New Carbine

?





## ***Additional Information***



- You have done a great job in meeting our wartime requirements
- We are reaching our requirement objectives
- We want to continue supporting this industry
- We need you to continue supporting us
- Full and open competition is always our endstate objective



U.S. Army Research, Development and  
Engineering Command



***TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.***

Propulsion System Design in Low  
Pressure Gun Systems

Carlton Adam, ARDEC  
18 May 2010

# Introduction



- ❑ A significant trend in large caliber ammunition today is demands for guided, non-line-of-sight munitions.
- ❑ These munitions typically rely on seekers, sensors, and aerodynamic control surfaces, i.e. delicate components.
- ❑ These qualities make the projectiles more fragile than the legacy ammunition that rely on overwhelming velocities or explosive mass to defeat targets.
- ❑ Such munitions require softer gun launches which pushes towards the low-end of the envelope of gun system performance.
- ❑ Since at least from the development of the MGM-51 *Shillelagh* in the 1960's, armaments engineers have struggled to find a good way to launch a missile-like projectile from a gun.

# Two Totally Different Performance Regimes

## HIGH PERFORMANCE/HIGH ENERGY

- Use all available gun tube strength to generate high pressures.
- Increase projectile weight or muzzle velocity as high as possible without damaging recoil system. Faster and heavier is better.



## SOFT LAUNCH/LOW PERFORMANCE

- Keep pressures and accelerations low to allow a wider variety of electronics and airframe options.
- Lift-generating and rocket powered projectiles need only a small initial velocity, however the gun typically needs a minimum velocity to cycle without jamming.



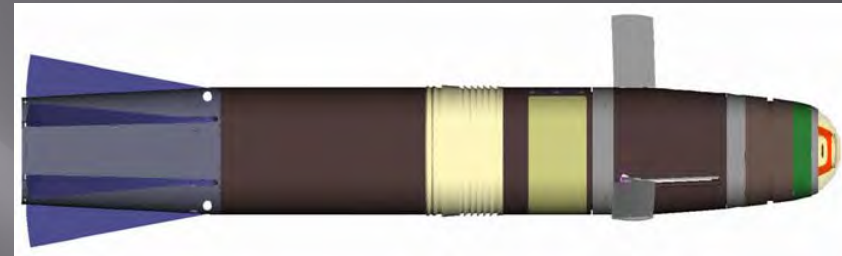
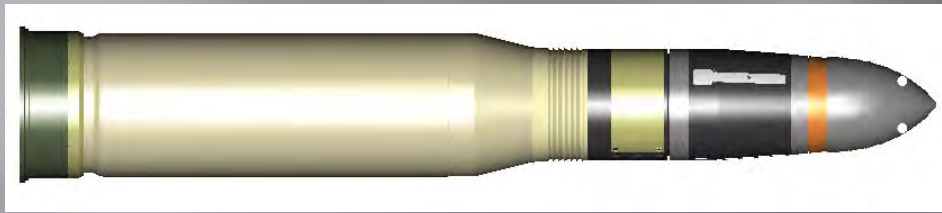
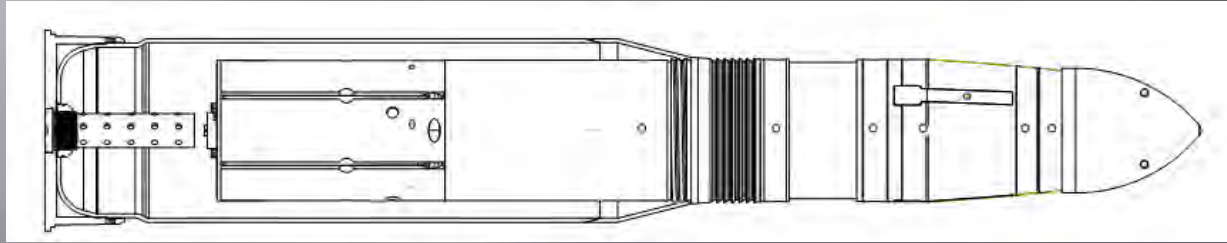


# About the Presentation

- ▣ The purpose of this presentation is to communicate to the gun and propellant engineering community the lessons learned regarding munitions design in a low-pressure, low-velocity system.
- ▣ The Mid-Range Mmunition (MRM) program is referenced often because it is the best example of this theme, however this will not be a presentation of the MRM program per se.



# Brief Overview of the MRM Round



## Key Requirements:

- ▣ Launched from 120mm Abrams main gun
- ▣ Has same survivability as legacy tank ammo, e.g.
  - Resistance to inadvertent ignition of energetic components
  - Resistance to physical threats such as being dropped or crushed

# Major Problem Areas

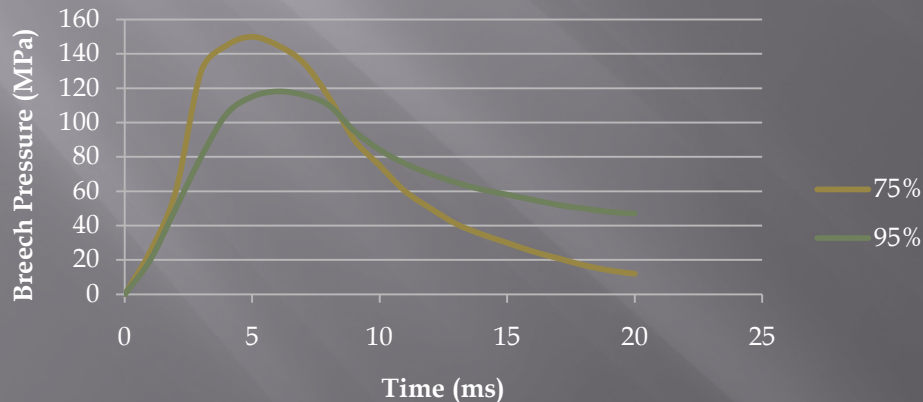
1. Incomplete propellant combustion (safety hazard)
2. Large amounts of paint residue from cartridge case (interferes with the chambering of subsequent rounds)
3. Low recoil resulting in unreliable operation of the breech mechanism (gun prone to jamming)

# Propellant Design

- St. Marks Hybrid® was chosen for favorable pressure/velocity ratio
- Propellant combustion time was maximized to keep gas pressure and projectile acceleration at a minimum



Base Pressure vs. Time for  
Propellant Burn-out as a Percent of  
Firing Time



- Area under pressure vs. time graph is proportional to muzzle velocity
- Therefore, the two graphs result in the same velocity, although one exerts a lower peak force on the gun and projectile

# Propellant Design

- ▣ Lengthening the time interval over which the propellant burns increases the risk of incomplete propellant combustion
- ▣ This is well-understood, however low pressure environments present a problem
  - Propellant burn rate usually not well-studied at low pressures
  - Closed bomb testing usually not optimized for pressures less than 70 MPa
  - Propellant burn rate is not linear, and large errors result from extrapolating burn rates from higher pressure regimes
- ▣ Without accurate burn rate data, propellant grain design becomes difficult and relies more on trial-and-error than solid engineering design.



# Propellant Design Conclusions

- ▣ Explore the low-pressure behavior of propellants more thoroughly:
  - Optimize closed bomb test setup for lower pressures.
  - Employ alternative test methods (strand burner) that are better suited for measuring burn rates at low pressures.

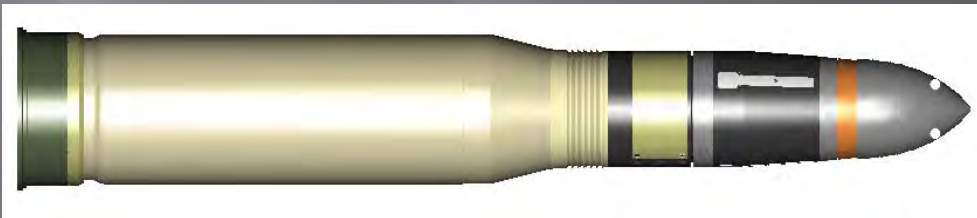


*Strand burner and closed bomb images courtesy of Design Integrated Technology, Inc.*



# Paint Residue

- ❑ The primary purpose of the paint is to *resist combustion* when the ammunition is subjected to external ignition threats such as sparks, flame, and hot surfaces.
- ❑ This conflicts with the requirement that the paint be fully consumed or ejected from the gun after the shot.
- ❑ Legacy ammunition is painted with an aluminized epoxy paint that meets both these requirements.
  - This paint was used for the first-cut MRM round for lack of any alternative and to avoid the design and qualification costs of developing a new coating.



# Paint Residue

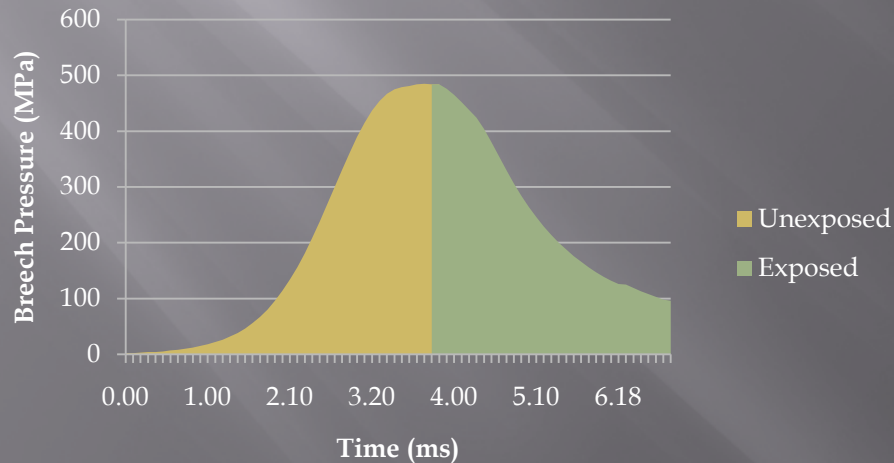


- ❑ Initial ballistic testing showed large amounts of unconsumed paint after almost all cold and ambient shots
- ❑ An investigation into this phenomena revealed several interesting things about the paint:
  - This paint does not burn per se, since its ignition temperature is above the propellant flame temperature.
  - The paint degrades slowly under high heat.
  - In legacy systems, a large amount of the paint is not consumed, but is instead fractured into small pieces and blown out of the gun (evidenced by confetti-like pieces of paint found in front of the gun)
  - This fracturing is believed to be caused by turbulence during the ballistic cycle.

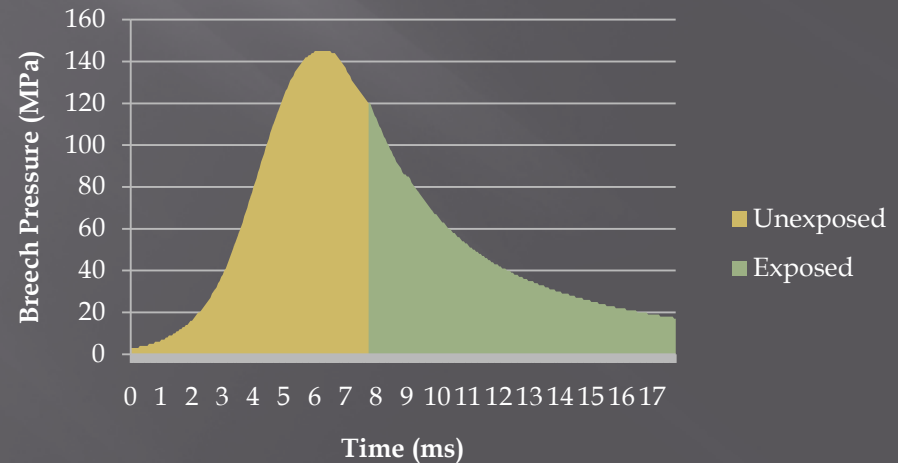
# Paint Residue

- Three major factors were postulated that contribute to paint residue:
  - Low pressure results in less mechanical action working on the paint, leaving behind larger chunks.
  - Low projectile/gas velocity results in less paint being expelled from the gun.
  - The combustible case protects the paint for a large portion of the ballistic cycle, specifically the portion where gas turbulence is highest.

**Paint Exposure to Propellant Gasses, M865**



**Paint Exposure to Propellant Gasses, MRM**





# Paint Residue Conclusions

- ▣ Try to understand paint behavior during ballistic cycle better.
  - Tailor the paint formulation and thickness to balance between low residue and good combustible case protection.
- ▣ Investigate alternative combustible case formulations with increased burn rate.

# Impulse, Recoil, and the M256 Cannon

Recoil: Distance traveled by the moving parts of the gun in reaction to the motion of the projectile.

Impulse: Momentum (force  $\times$  time) felt by the gun due to the motion of the projectile.

- ▣ Breech on M256 cannon opens automatically at the end of the shot cycle
  - This is accomplished by compressing a spring using the recoil of the gun, then using the spring to drive a cam that opens the breech.
  - This operation is expected to be reliable by the tank crew; a breech that fails to open is considered a malfunction.
- ▣ Recoil is controlled by the spring and a hydraulic damper.

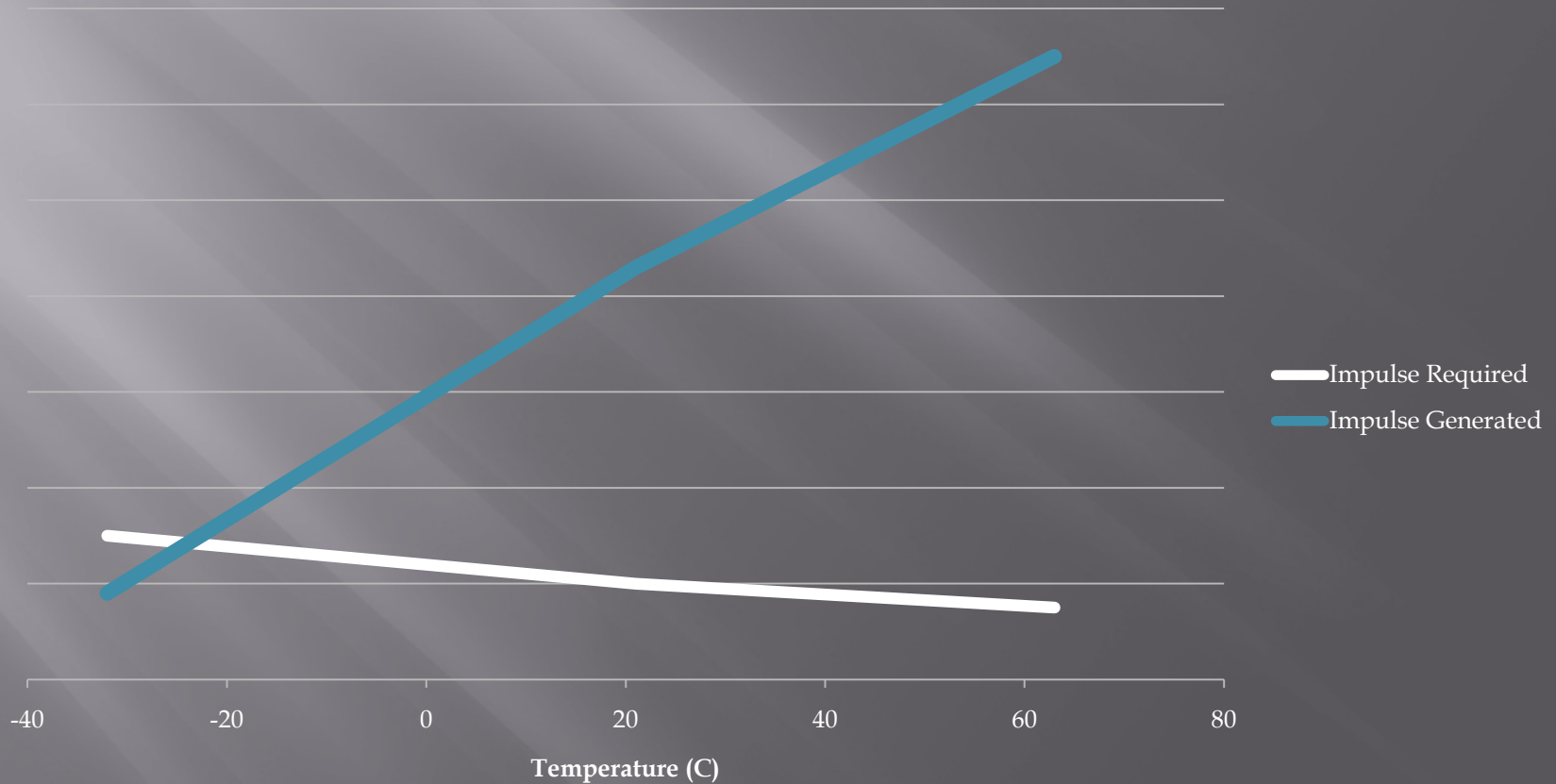


# Low Impulse/Low Recoil

- ▣ Since impulse is mostly generated by the momentum of the projectile ( $\text{mass} \times \text{velocity}$ ), low velocity results in low impulse and shorter recoil.
  - Critically short recoil will prevent the breech from engaging the cam and the breech will not open.
- ▣ Although the M256 breech assembly functioned reliably during MRM ballistic testing, the gun was always at “Yuma Ambient” temperature (70+ °F)
  - In a cold gun, the hydraulic fluid is more viscous and exerts more damping force on the gun.
- ▣ MRM recoil was at the lower limit of that required for reliable breech operation, according to recoil models.

# Limiting Temperature

MRM Impulse Generated and M256 Impulse Required as Functions of Temperature



# Recoil and Impulse Conclusions

- ▣ Increase fidelity of recoil models
  - Include effects of dimensional tolerances and worn parts
- ▣ Supplement modeling efforts with recoil/impulse data from cold and hot-conditioned guns
- ▣ Include minimum recoil as a design requirement (duh).
- ▣ Begin designing guns that tolerate larger ranges of impulse across larger temperature ranges.

# Conclusions

- ▣ Low pressure gun systems create obstacles that are just as challenging as their high-pressure counterparts.
- ▣ These challenges require different strategies and different ways of thinking about the gun system.
- ▣ New tools and test methods may be required to overcome these obstacles.

# Acknowledgements

Monica Curcione – *General Dynamics, Ordnance and Tactical Systems*

Jim Drummond - *General Dynamics, Ordnance and Tactical Systems*

John Bednarz – *Raytheon*

Office of the Program Manager for Maneuver  
Ammunition Systems (PM-MAS) – *Picatinny Arsenal, NJ*



# Making Affordability Work



+

**Raytheon**

*Customer Success Is Our Mission*

**The Army's Home for Lethality**

Mr. David Panhorst  
U.S. Army ARDEC

Mr. Dan Klingberg  
Raytheon



# Storyline



## ■ Application of an Government/Industry affordability approach on one program

- Mid-Range Munition – PM MAS
- Contracting Agency – ARDEC
  - Picatinny Arsenal, NJ
- Prime Contractor – Raytheon
  - Missile Systems, Tucson, AZ
- Teammate – General Dynamics
  - Healdsburg, CA
  - Niceville, FL
  - Red Lion, PA
- Integrated Product Team Approach

## ■ Creating an environment for success

- Program infrastructure
- Cost model helps identify what drives cost
- Defining Cost Reduction Opportunities (CROs)

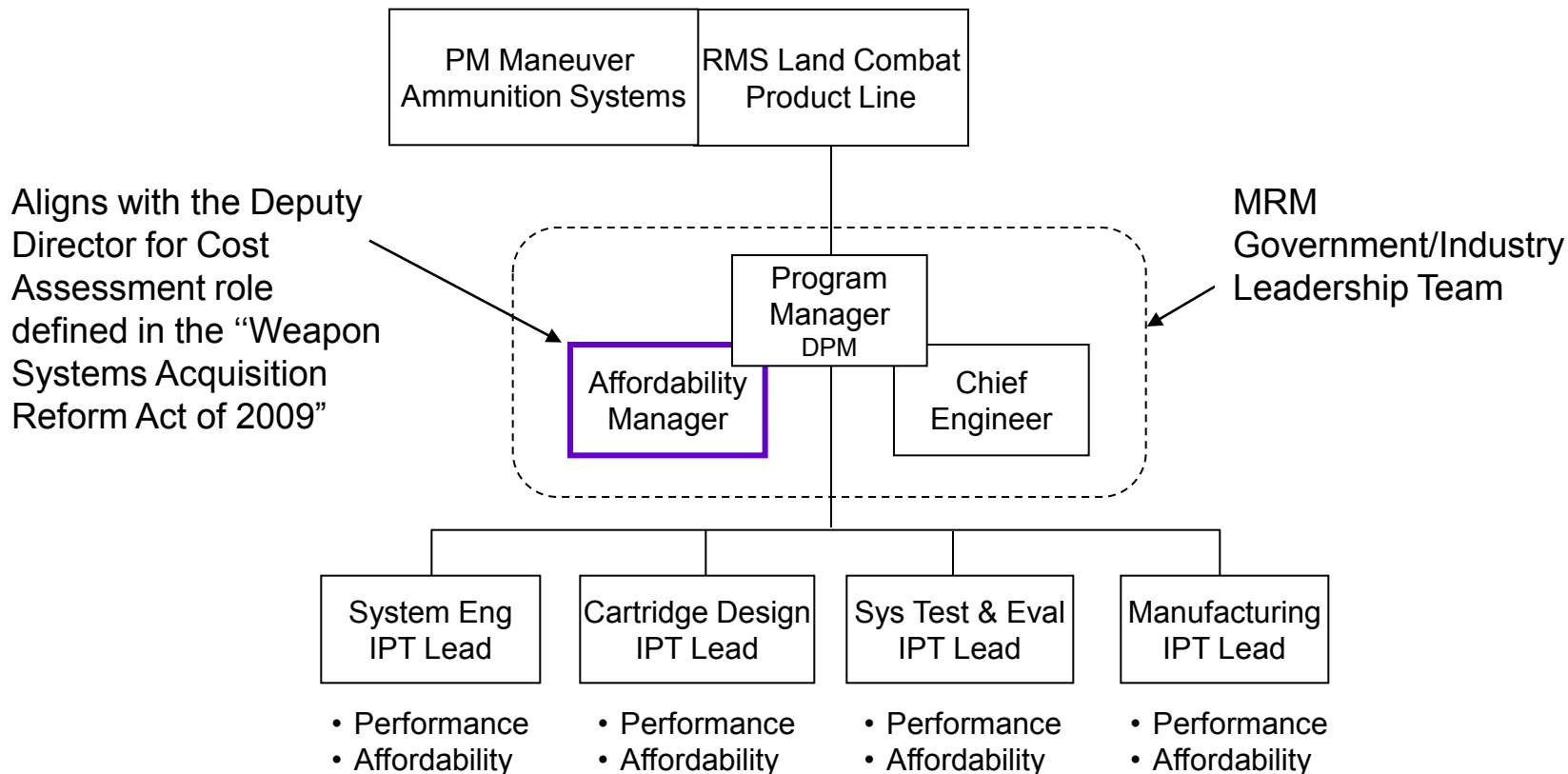
## ■ Examples of success

## ■ Impediments to implementation





# Government/Industry Affordability Leadership



**Entire Structure Consists Of Government/Industry Counterparts**

**New Role Drives Accountability To AUPP**

**Raytheon**

*Customer Success Is Our Mission*

Use or Disclosure of Data Contained on the Page is Subject to Restrictions on Title Page





# Definitions



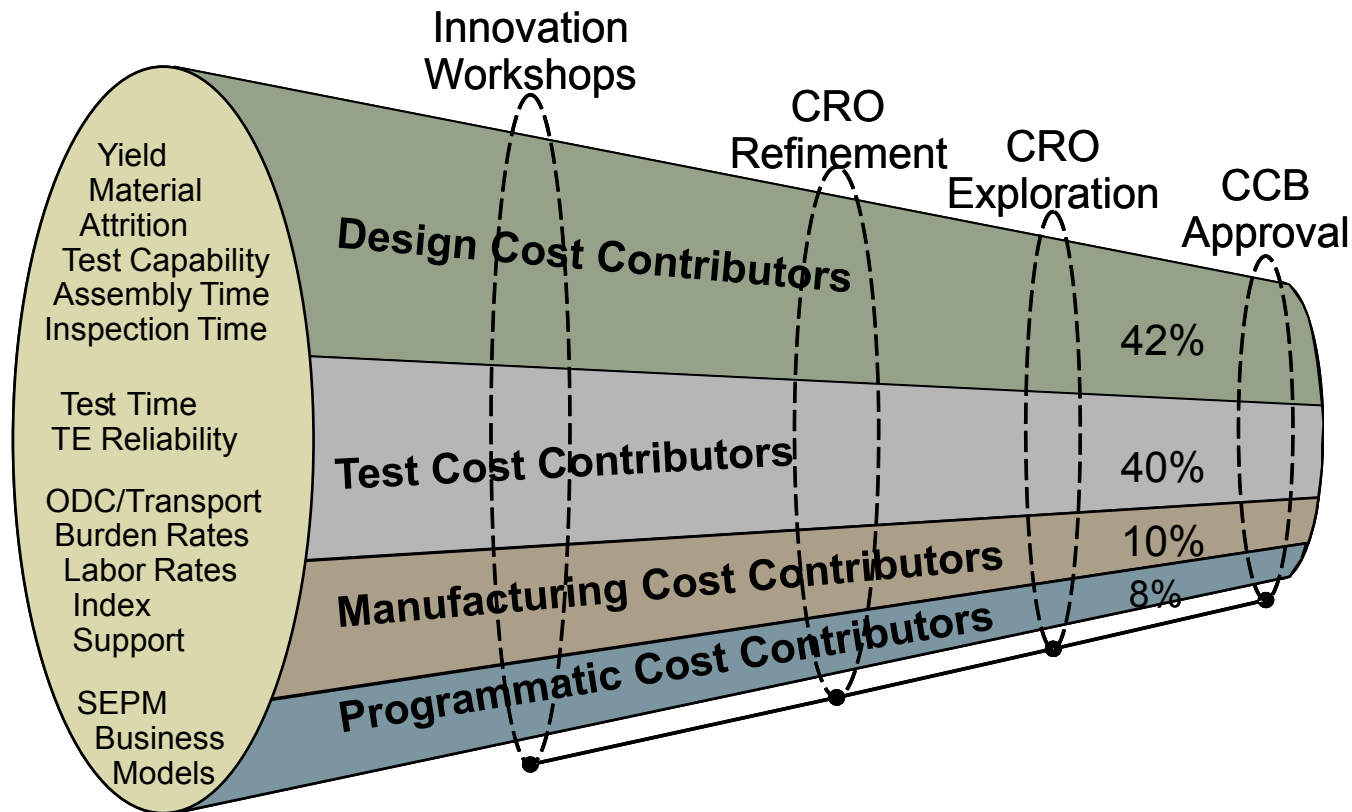
- **Program Affordability Management**
  - Supervises and structures activities that drive the cost requirement
  - Integrates traditionally siloed activities
    - Systems Design
    - Design Engineering
    - Systems Test
    - Operations
    - Supply Chain
    - Life Cycle Engineering
    - Program Office
    - Knowledge Management
    - Cost Estimation
  
- **Affordability versus Producibility**
  - Affordability - Delivery of the desired number of production units at the required cost
  - Producibility – The most effective and efficient manufacturing process



# Cost Contributions Identified Across Disciplines



- Emphasis on system performance does not support cost requirement
- System Architecture Defines System Cost



**Requirement Trades Guide Cost Reduction Opportunity (CRO)**





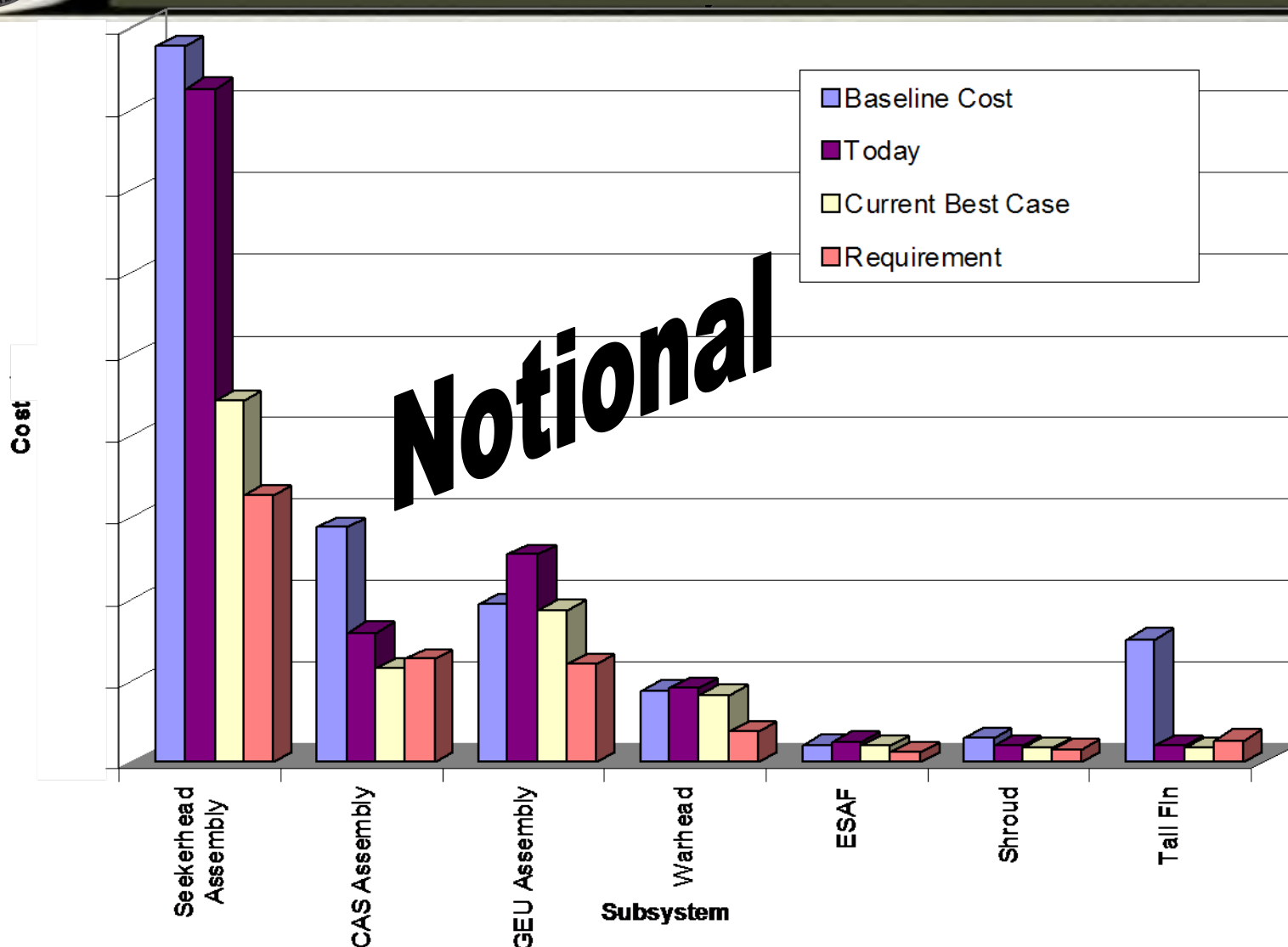
# Enabling An Affordable Solution



- **Know your cost requirements and understand your cost drivers**
- **Aggressively identify cost reduction opportunities**
  - Identify requirements that drive cost and flow it back to systems engineering
- **Incorporate Critical Parameter Management to match manufacturing process capability**
- **Make affordability part of individual development goals**
  - Co-develop an affordability incentive program with the customer



# What Drives Cost?



Close Gap Between Current and Future State

Raytheon

Customer Success Is Our Mission

Use or Disclosure of Data Contained on the Page is Subject to Restrictions on Title Page

Best Case = 100% Of CRO Savings Realized





# Identify Cost Reduction Opportunities

Targets/ Tactics	Functions (Purposes)	Sub- Systems (Parts)	Material (Infrastructure)	Processes (Things to Do)	People
<b>Eliminate</b>	Can we eliminate a function? 16	Can we eliminate any parts? 18	Can we eliminate any costly materials? 20	Can we eliminate any process steps? 44	Can we eliminate the need for special skills? 12
<b>Reduce</b>	Reduce functional performance? 13	Reduce parts by combining functions? 42	Reduce amount of materials needed? 9	Reduce complex processes? 20	Reduce number of people required for service? 9
<b>Substitute</b>	Substitute a new function for an old one? 8	Substitute an off-the-shelf parts? 19	Substitute a more easily obtained material? 21	Substitute a known process for a new one? 10	Substitute lower skilled people? 6
<b>Separate</b>	Separate functions to improve use? 5	Modularize parts to make them easier ot service? 3	Separate insert molded parts for easier re-cycling? 2	Separate automated processes from manual ones? 3	Separate dangerous materials from humans? 2
<b>Integrate</b>	Integrate functions to make it easier to use? 8	Connect two parts to deliver more value? 11	Integrate two materials into one part? 8	Integrate several process steps into one? 7	Integrate human tasks into automatic ones? 7
<b>Re-Use</b>	Re-use a previous functional solution? 10	Re-use previously proven design solutions? 9	Re-use well known materials for less risk? 4	Re-use conventional manufacturing processes? 6	Re-use same pople for similar tasks for better quality? 5
<b>Standardize</b>	Specify a standard functional process? 4	Use standard, off-the-shelf high production parts? 9	Use readily available low cost materials? 12	Specify standard service processes? 11	Design product for standard skills and techniques? 5
<b>Increase</b>	Add a function to improve overall value? 16	Add greater value to existing parts? 15	Add materials to deliver more performance? 10	Add processes to assure quality? 12	Add people to provide better, faster service? 6
Total Idea Count: 425					



# Refining Cost Reduction Opportunities

## **1. Innovation Workshops**

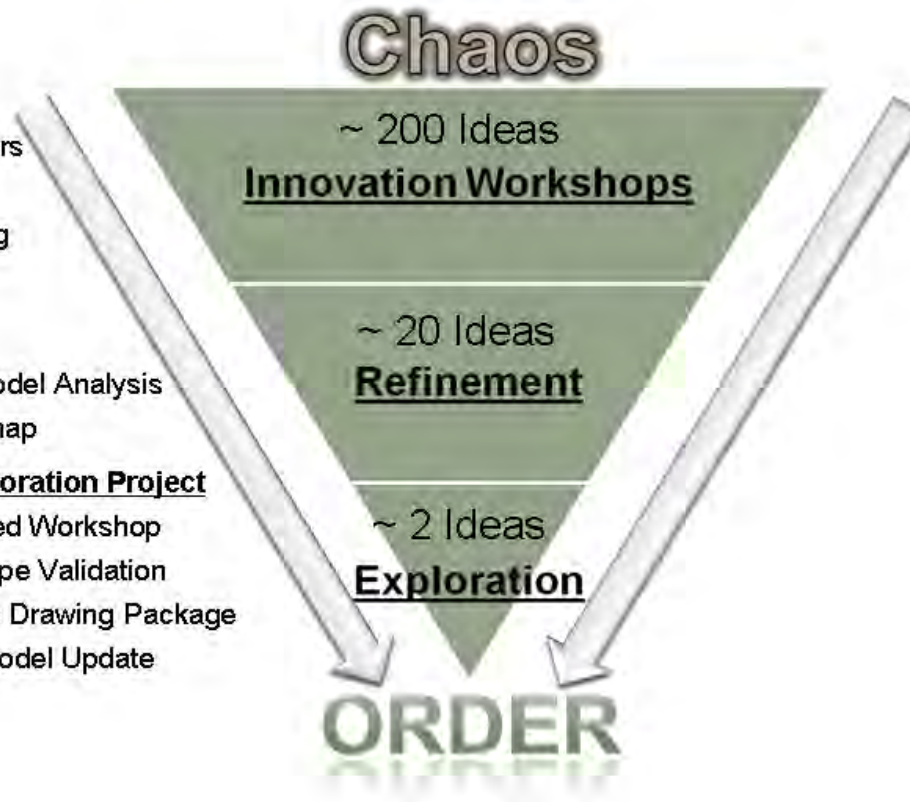
Definition of Trade Space & Cost Drivers  
1 – 2 Day Focused Idea Generation  
Cross Functional With Outside Thinking

## **2. Refinement Project**

Opportunity Worksheet  
Cost Model & Performance Model Analysis  
IPT Schedule Insertion Roadmap

## **3. Exploration Project**

Targeted Workshop  
Prototype Validation  
Update Drawing Package  
Cost Model Update



- **Fixed Budget is allocated to reduction activities**
  - **Benefit ratios determine feasibility**
  - **Benefit thresholds determine forward progress**
- **Benefit ratio becomes less efficient as program matures**

**Funding Applied To Tiered Improvement Approach**



# Critical Parameter Management



- **Collects manufacturing variation data**
  - Provides a quantitative way to focus on design and process capability interaction
- **Combines design requirements with process capability**
  - “. . . Product variation has been called the “silent killer” on the manufacturing floor . . .” – GAO Report, Capturing Design and Manufacturing Knowledge Early Improves Acquisition Outcomes



**Understand Effects Of Manufacturing Process  
Capability On The Design**





# Success Stories



- **First year cost reduction of 40% is ahead of the burn down plan**
  - Automated seeker test time reduction of 35%
  - Seeker design CROs identify a 14% cost reduction
    - Gimbal mapping reduction, alternate gimbal actuator
    - Injection molding the primary, secondary, and forward support
  - Control Actuation System (CAS) CRO insertions reduce material cost by 30%
    - Uni-core, low cost motors, machined aluminum canards, new deploy mechanism
- **Trades resulted in relaxation of secondary seeker mirror requirements**
  - Design, tolerance, or manufacturing process parameter modifications resulted in significant Cpk improvement

**Affordability Successes Breed Additional Success**



# Co-developed Incentive Program



## ■ Industry Incentives

- Dinner and a movie awards
- Peer recognition
- Merit ranking and rating impact

## ■ Government Incentives

- Unit Production Cost (UPC) is a significant percentage of the Award Fee throughout the program
- MRM SOW defines unique requirements that drive a change in methodology
  - “Provide data & models to assess Life Cycle Cost”
  - “Continuously assess each component to identify & reduce cost drivers without compromising KPPs”
  - “Summary of Producibility ideas incorporated & estimate of savings”
  - “Summary of ideas investigated but not incorporated and why”

**Program Leadership Fosters a Culture Uniquely Aligned  
On Affordability**



# Impediments to Implementation



## ■ Culture

- Changing the mindset to make affordability everyone's responsibility
- Not-invented Here (NIH) – at first there was a reluctance to change from doing things the way we always did them
- “If you don't do things differently, you will always get the same result”

## ■ Performance Requirements

- All design attributes seem to be equally weighted

## ■ Broke the cost requirement into manageable lanes (slide 7)

- Design team has no bearing on transportation cost

## ■ Affordability manager controls the budget

- Funds dedicated to affordability at the outset of the program – funds supplied by each IPT Lead

**Consistent Message from Government/Contractor  
Counterparts kept the team on track**



# For Further Information



- **David W. Panhorst**  
**US Army ARDEC**  
**Chief, Munitions Sensors and Guidance Technology Division**  
**RDAR-MEF-S / B.94**  
**Picatinny Arsenal, NJ 07806-5000**  
**(973)724-5525**  
[david.w.panhorst@us.army.mil](mailto:david.w.panhorst@us.army.mil)
- **Daniel Klingberg**  
**Raytheon Missile Systems**  
**Production Program Manager Paveway**  
**PO Box 11337**  
**Tucson, AZ 85724-1337**  
**USA**  
**(520)663-9247**  
[dtklingberg@raytheon.com](mailto:dtklingberg@raytheon.com)